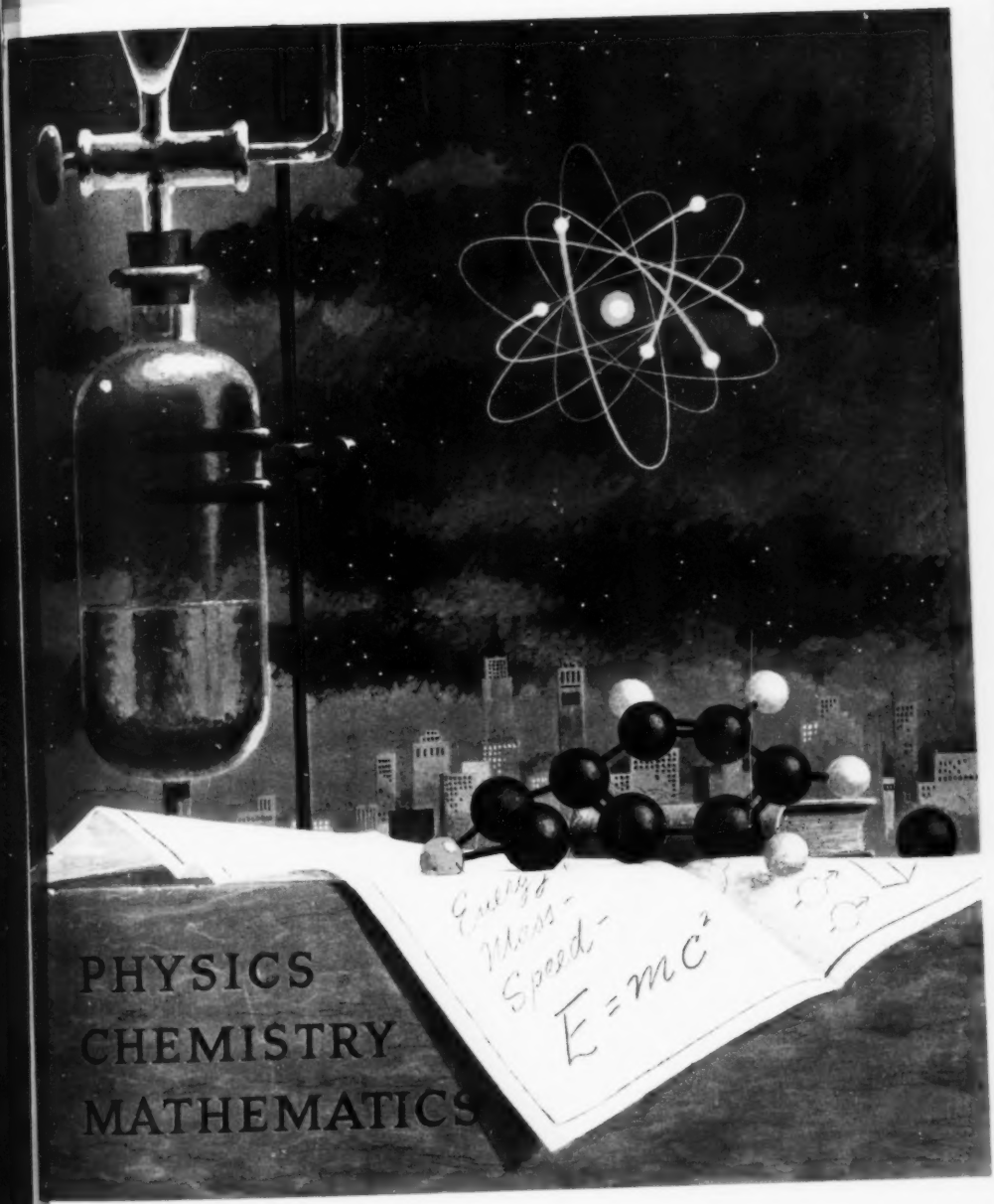
WINTER 1957-58



Tools of basic research

VOLUME XXXVI NUMBER FOUR WINTER 1957-58

Bell Telephone Magazine

A non-technical review, published quarterly to give Bell System management people a broader view of the history, objectives, operations, and achievements of this business than they might attain in the course of their day-to-day occupations, and an added sense of participation in the problems and accomplishments of our nation-wide public service.

Cover: "Tools of Basic Research." Painted for this Magazine by *Robert Geissmann*

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A MEDIUM OF SUGGESTION and A RECORD OF PROGRESS

JUDSON S. BRADLEY, *Editor* SALVATORE J. TAIBBI, *Art Editor*

Published for the Bell System by the Public Relations Department, American Telephone and Telegraph Company, 195 Broadway, New York 7, N. Y.

FREDERICK R. KAPPEL, *President* S. WHITNEY LANDON, *Secretary* JOHN J. SCANLON, *Treasurer*

XUM

Who's Who & What's What In This Issue

A NEW and characteristically informal picture of FREDERICK R. KAPPEL appears here, accompanying his "Business Needs Basic Research." The significant facts about the president of A. T. & T. haven't changed materially since our issue of three months ago, which carried his "Common Goals for Changing Times." And so we simply reprint here the "biographical data" which appeared then in this space:—

FREDERICK R. KAPPEL was elected president of the American Telephone and Telegraph Company on September 19, 1956. He had been president of the Western Electric Company, the manufacturing unit of the Bell System, since January 1, 1954. Mr. Kappel started in the plant department of the Northwestern Bell Telephone Company in 1924. In the next few years he held many assignments in the plant, engineering, and commercial departments—all in Minneapolis. Ten years after he had joined the Bell System, he went to Omaha as plant engineer of the Nebraska-South

Frederick R. Kappel

Frank Cameron

Dakota Area, and three years later he was plant operations supervisor on the staff of Northwestern Bell at Omaha. In 1939 he became assistant vice president of operations, and after three years he was elected vice president of operations and a director of the Northwestern Bell Telephone Company. He came to A. T. & T. in January, 1949, as assistant vice president in the Department of Operation and Engineer-

Arthur B. Goetze

ing. In February of that year Mr. Kappel was elected vice president of the Long Lines Department. In November, 1949, he returned to the General Departments as vice president in charge of Operation and Engineering. He remained in this post until he became president of Western Electric.

ALTHOUGH FRANK CAMERON professes, at the start of his article about laying the Hawaiian cables, to be ill at ease aboard ship, that must be a bit of artistic license; for after college, and, as he phrases it, "during the big depression," he not only went to sea, but worked up from able seaman to chief purser—the latter on cruise ships to the Caribbean and South America. Followed more months aboard transports to the South Pacific during World War II, and then work for the United States War Shipping Administration. Eventually, he began writing publicity for one of the steamship lines. Then he moved to California, in 1946, and there wrote "Cottrell: Samaritan of Science," which Doubleday published and which won a Commonwealth Club Literary Award. Now an established free-lance writer, he has had articles in the *Saturday Evening Post, Life, Readers' Digest,* and half a dozen other important publications including (he writes) "I hope, BELL TELEPHONE MAGAZINE."

IT IS INDICATIVE of how Bell System people move up the ladder of success that ARTHUR B. GOETZE succeeded as president of Western Electric the man who had quit that office to become head of the American Telephone and Telegraph Company. There is nothing significant in the fact that they are both contributors to this issue; that is just happy coincidence.

Mr. Goetze entered the Western Electric Company at the age of 16 as a draftsman at the Hawthorne Works in Chicago. He attended evening classes, and in 1921 transferred to the Engineering Department and in 1922 attained supervising duties in the drafting room. A variety of supervisory jobs preceded his transfer in 1928 to Company headquarters in New York. In 1930, he was named assistant

(Continued on page 65)

George M. Dean

The White Alice communications network Western Electric is building in Alaska employs "over the horizon" microwave transmission. One of the major defense projects W. E. is uniquely qualified to perform by virtue of its Bell System experience (see Mr. Goetze's article, page 31), the White Alice system embodies as well the fruits of Bell Telephone Laboratories fundamental research—in "tropospheric scatter" effects—the values of which Mr. Kappel discusses in his article beginning on the opposite page.

We face the new and mighty competition of science and new knowledge in the hands of determined men who mean to rule the world

BUSINESS NEEDS BASIC RESEARCH

FREDERICK R. KAPPEL

President, AMERICAN TELEPHONE AND TELEGRAPH COMPANY

(A talk before the Economic Club of New York on January 21, 1958)

I'LL BEGIN by showing you two or three things and then I want to talk about something else.

This may seem like a double-jointed way to give a talk but I promise you it isn't as irrational as it sounds.

First, here is a short length of what in the telephone business we call a waveguide.

It does just what its name implies. In radio relay systems, which carry thousands of telephone conversations and also TV programs, this kind of structure guides radio waves in and out of the amplifying equipment at each relay tower. Some day, we are confident, new forms of long distance waveguides will carry hundreds of thousands of conversations, and hundreds of TV pictures, across the country under ground.

Here is another piece of hardware. This is part of what we call a "pulse code modulation terminal." But never mind the name. This is new transistorized equipment. It takes samples of voice currents in pulses of millionths of a second. Many sets of these samples, each with its own code, can travel over a telephone line only millionths of a second apart. So for all practical purposes they go over the same wires at the same time. This system is so efficient, we are sure we can use it to multiply talking paths over many short routes more cheaply than by installing more cables. Thus we can begin to do *within* local telephone exchanges what we have been doing on long distance lines for many years.

Now I'm going to ask you to listen to something for a moment. It is a tape recording of a test of an entirely new kind of telephone call. This call, like most others, starts with the sounds of dialing.

(A short recording of a test of dataphone service was played.)

You have just heard one clerk call another and transmit data over a regular telephone circuit. This is dataphone service, and dataphone means just what it sounds like—sending data by telephone.

XUM

A dataphone instrument is associated with a telephone. You make a call in the usual way—local or long distance—through the regular telephone network. Then you push a button. The dataphone instrument accepts electrical impulses from different kinds of data-producing machines, and sends them over an ordinary telephone connection. At the far end the tones you heard are converted back to impulses which reproduce the data. When your business is done, you simply hang up the phone.

Now back to the call you heard. It had only 20 seconds of data transmission, so as not to bore you, but the information sent in that 20 seconds is equivalent to the inventory position of 150 items in a supermarket. To say it another way, the supermarket's entire inventory of some 7,000 items could be sent in 16 minutes. Here's what we sent. The entire inventory listed this way would be 194 feet long.

Dataphone service is brand-new. But we think it has tremendous possibilities for usefulness.

The search for new knowledge

As I SAID at the start, however, these things I've been showing you are not what I'm here to talk about. My subject is rather the fundamental, underlying effort which makes all such progress possible. This is the search for new knowledge—the effort to increase our understanding of nature—the probing into the unknown that we call basic research.

If it were not for basic research, none of these things I have shown would exist. The services we provide would have nothing like their present and potential usefulness. For that matter, there would be no telephone system comparable to what we know. These examples merely illustrate that general point.

The waveguide of today was born of mathematical thinking that started 30 years ago, and the wave guides of tomorrow are being born of new equations that men are laboring with right now. The process of sending information by pulsing and coding grows out of entirely new funda-

mental theory as to what communication really is. Dataphone service is only possible because of the reliability which new knowledge, step by step, has built into the telephone network.

So we in the Bell System are deeply committed to basic research. This has been essential not only to provide universal service but to cope with inflation, reduce the effects of rising costs, and increase our markets in competition with other industry.

Now perhaps in the past we telephone people have had more need for research than others. However, I question if this is any longer true. One reason why I question it is that today all industry in the free world faces a new kind of competition. Soviet science is moving with tremendous mass and terrific momentum. It has stepped out into space ahead of us and it would be sheer folly not to recognize its driving will to step ahead in every other way. This is not just a matter of missiles and satellites. It is much, much more. It is a matter of markets—of leadership in trade and commerce—of the power of free industry to strengthen the public welfare and to win and keep world-wide esteem.

In the past, American industry has led the world largely because we have used existing knowledge with great ingenuity, developed new products, and introduced all kinds of innovations in organizing people and machines.

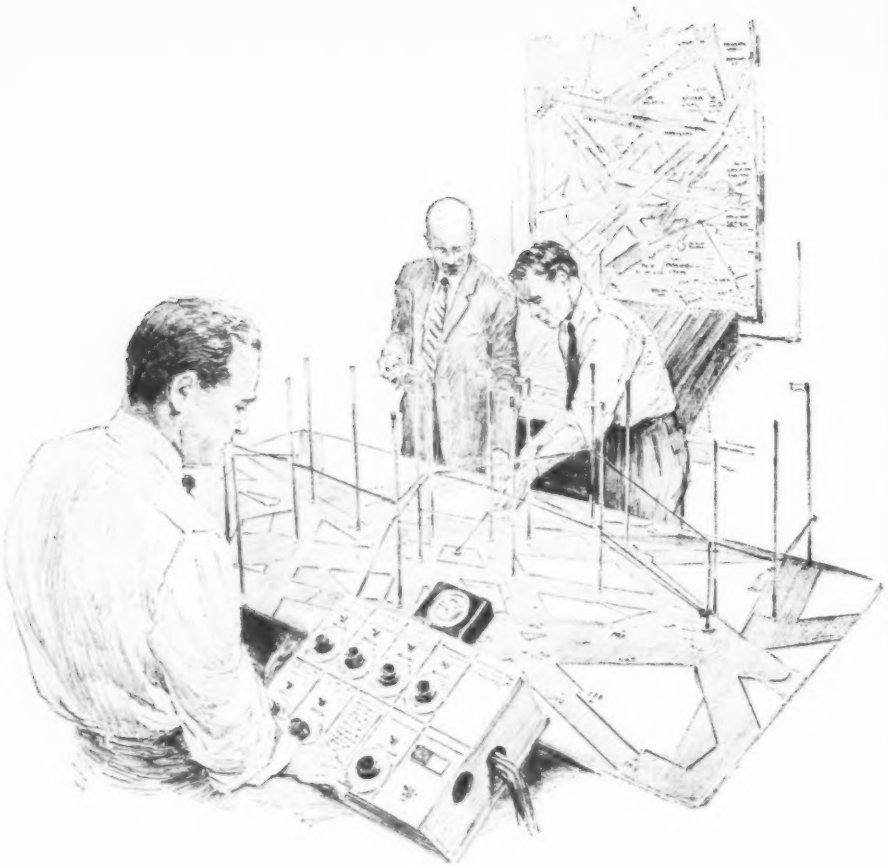
But now, as I have said, we face the new and mighty competition of science and new knowledge in the hands of determined men who have flatly told us they mean to rule the world.

Can competition on this plane be successfully countered by purely industrial and productive skills alone? Not in my judgment: no more than the competition of the telephone could be met by the most

artful ingenuity in the development, design, and mass production of megaphones; no more than the internal combustion engine could be matched by giving the horse an extra quart of oats and putting ball bearings on the buggy.

Who should carry on basic research?

It seems clear enough that the country as a whole is waking up to the need for science that will bring new knowledge in abundance. And we are getting more of it —much more—than we were getting twenty or even ten years ago. The part I want to touch on is only the part of industry. Many businesses today must be asking:



"Should *we* be doing more basic research? How should we go about it? And what is our risk?"

Therefore what I shall mainly do here is lay out a few facts and judgments growing from our Bell System experience, and hope they will be helpful to other industries in coming to their own good answers.

Take first the question, "Is the quest for new knowledge something that really belongs in industry? Or does it belong rather in the universities and in government, with industry applying the results?"

I'll mention a few of the things our Bell scientists think about that, and reserve my own comments for later. They say: certainly basic research must be done by the universities and government, but there is great advantage—and great need—to do it within industry as well. For this there are several reasons.

The first is that the interaction of basic research with the other phases of an industry stimulates everybody. Basic researchers and development engineers working fairly close to each other in a dynamic atmosphere sharpen each others' wits. Why then should an industry choose to do without this stimulus—in fact, how can it afford to do without it?

A second reason is that the technical organization which includes a basic research group thereby takes out insurance against possible costly mistakes. The cost of development is far greater than the cost of research, and if a big undertaking gets off on the wrong foot the price is terribly high. Granting that any careful organization will try to guard against this—still there is no precaution quite as sound and sure as having basic research people right in the organization who are working at the deepest roots of the problem.

A third reason is that at any particular time, university scientists may not be working on the things that would do your business the most good. No matter how important their work is to them or to others, it may not be getting the new knowledge that *you* most need. A good example is the work which produced the transistor. University physicists were busy on other things. Our Bell System research opened up the field.

Well, the scientists no doubt have other reasons; but these are enough for the moment. I said I would reserve my own comment and I will make it now. As a business manager, I think these points make sense. I think this for the very practical reason that these are some of the ways in which our basic research has worked well for us. How it may be for others, only they can decide.

Essentials to research

NOW LET'S THINK about costs. Of course the cost of research is a business risk. But in any field of business, if we face new problems we must take new action. If we face new danger we must take new chances. And if the danger we face is to fall behind in knowledge, then it seems to me that taking the new risk becomes imperative.

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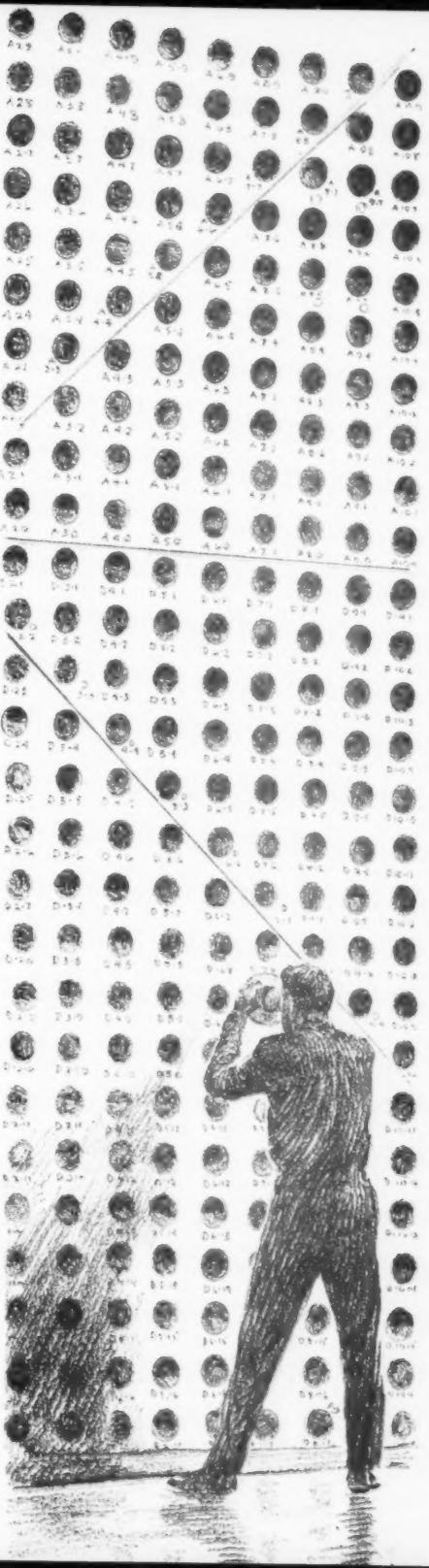


Moreover, while we shouldn't underestimate the cost, we shouldn't overestimate it either. The fact is that a large business can do a lot through expenditures which, in relation to total volume, ought not to frighten anybody.

Someone may say, "That is all very well, but you in the Bell System have a pretty stable business and you don't have to meet the same kind of competition that other businesses do." I won't argue the point because I don't think I need to. The fact is that we work under regulation and on a much lower profit margin that most big industry. We do basic research on a thrift basis and we get back far more than we put in. Others who have more ample resources would in my opinion get back at least as much as we do.

Really, I think most of the hesitation about going into basic research is due to a worry that all the money may go down the drain. If you go at it the right way, however—and I'm coming to that directly—this ought not to happen. And even if it does take time to get results, when you put the cost into perspective with everything else a big business does, I don't, as I've said, see much cause for alarm. Finally, if you will accept the proposition that we surely do have a new kind of competition to meet, and must have new knowledge to meet it, then I think it ought not to be hard to show the stockholders that knowledge-building dollars are a good risk against the ultimate calamity of having commissars run your business.

Now I shall summarize some of the principles we regard as necessary to the success of basic research in the Bell System.

The first is to get the best possible people. Getting new knowledge takes a special brand of brains. And they must be well and deeply trained. Without this combination, nothing will be accomplished.

Second, you have to have an objective but you also have to give the brains full freedom. Maybe those two things will strike you as mutually exclusive. That hasn't been our experience. We have the broad objective of improving electrical communication. This is a perfectly clear goal. At the same time, it gives the research scientist full scope for the exercise of his creative power. If you question this, I suggest you ask our scientists.

Now what is meant by freedom for the researcher?

For one thing, he must be free to do what he wants to do in keeping with the broad objective, and knows he can do best. If a line of work is proposed and he says

"no," take his word for it. He knows more than you do.

The scientist must also be free to plan his work in his own way. You cannot plan it for him. This means there are no schedules. There is no program by the clock or even by the calendar. After all, Isaac Newton was musing under a tree when the apple dropped on his head. The laws of gravity were not formulated on schedule.

The research scientist should also be free to publish his findings without undue delay. And you should also let him carry his work up to the point where he is sure its meaning is fully grasped by those who will go on with the development.

But it is right at this point that we bump up against the third and most difficult essential in maintaining basic research. This is to keep the researcher from becoming a developer. And this is the mistake that every research scientist will warn the business manager against. When basic research is swallowed up by development, then basic research stops. The only assurance of getting new knowledge is to insist that the research group stay a research group. When one piece of research is done, the results must be given to others for development and the researchers must turn to a new basic problem.

Finally, basic research today needs adequate equipment. To give just one example, in our Bell Laboratories research we study the basic characteristics of all manner of materials. To do this we must look at them in every possible way. This requires using many different tools, and they represent a not inconsiderable investment.

There is one thing I ought to emhasize particularly in this list of essentials. That is the disposition and temper of the manager who holds the purse strings. Of course

he is itching for results. But he will have to be patient. And if you will let me speak personally for a moment, I will say just this: Whenever I get impatient, there are two thoughts I use to restrain myself. The first is that research requires no more patience on my part than it does of the man who is doing the work. And the second thought that helps me is—thank heaven we have the research that I can be impatient about.

Finding the right men

So much for basic principles. But I daresay some of you would have liked to stop me right after the first one—that is, that success begins with getting the best and the best-trained men. Your questions might be, for example, "How do we find them? Isn't industry already taking too many of the best scientists away from the colleges? Are not these great difficulties?"

Certainly they are difficulties. Everything about research is difficult. Nothing is easy. And I don't say for a minute that industry is going to march ahead in research if public opinion and education and industry's own support of education don't march too. Nevertheless, our own scientists are convinced—and I am too—that if

good men are genuinely and urgently wanted, step by step and year by year good men will be forthcoming.

In the Bell Laboratories we spend time and money training men of promise who do not yet have the depth of training needed for research. We make arrangements with nearby universities for additional training. Moreover there is no telling how many men with the capacity for basic research are now doing development work in industry because it is in that field, rather than in the search for new knowledge, that the most opportunity today is offered.

In short, the only way to begin is to begin. And I might remind you that there is more than one useful and thriving company at work today which literally got born doing research within the last few years. Their experience also throws light on another question, which is, "How long should it take, starting from scratch, to make real progress in basic research?" When I ask this of our own research people, their confident answer is that 10 years' effort will produce real accomplishment.

What is our responsibility?

Now I SHALL CLOSE by inviting leaders in industry, and leaders also in government, to consider a single question. It is simple and short; merely this—

"What is our responsibility?"

For many years now big business has been under the necessity of justifying its existence. This is perfectly natural. Big business *does* affect the lives of everyone and it *must* continuously prove by its actions that everyone benefits. To me, and I daresay to you, the evidence of the benefits is overwhelming:

— in the capacity to take on big jobs that depend on big investment.

— in the creation of new opportunities for small business.

— in the sheer ability to produce in vast quantity at low price.

— in the strength that armed ourselves and our allies in two world wars, and but for which this country today might be an overseas province of, let us say, the Third Reich.

Our need to prove ourselves will never end, but I want to make this observation: It seems to me that at no time in this century has the man in the street had more reason or instinct to look hopefully and even prayerfully to big business than he has right now. He has a thunderclap awareness that it is big and mighty effort which has rocketed a living creature up out of the atmosphere and into the silence of space. His instinct and acknowledgement *must* be that the Soviets' kind of bigness can only be countered by another kind of bigness—and I mean our kind, which mixes bigness and freedom. So I think today we have the *potential* for a new degree of public understanding of big business, and a new public awareness that the future depends very largely on big industry and on keeping it sound and strong.

To say this, however, is only to say that our responsibility grows accordingly. And if it should be—and I am putting the question to you—if it should be that industry should fall short, not in skill or ingenuity, or organizational teamwork, or productive or marketing savvy—not in any of these things, *but in getting new knowledge*—then what degree of public understanding and approval should we expect, say, ten or twenty years from now? And is that the kind of risk we want to take?

In our own case, as a public utility, to do the most effective research job we need the full understanding and support of the regulatory commissions. We are regulated in every state, and in some of them you would almost think the sole purpose of the regulation is to keep us from earning enough money to do a better job. In the postwar period as a whole, this paucity of earning power has limited and circumscribed our effort. We have done a great deal, and I am only stating the fact when I say that this has opened up prospects for the future of communications that are beyond all calculation. Nevertheless, I think we would have done more, and be somewhat further into the future than we are today, if the conditions imposed on us had been less stringent.

Finally, let me address a few remarks to those people both in and out of public office who for reasons best known to them-

selves seem dedicated to the effort to harass and attack big business, and to cut it down to some other size of their own choosing.

I ask them to stop, look, and listen. A few minutes ago I was saying that the cost of basic research is nothing for a big business to be scared of. However, I didn't say it was free. It is in fact big enough to require big resources. For one thing, the research group needs to be large enough for its members to spark each other, and to attract the top-notch people who want to work in a scientific community that draws others of equal caliber.

So if basic research within industry is really going to grow, it is going to have to grow in big organizations. I don't mean there isn't room for it in smaller ones, especially when they are doing work for the government and the cost gets paid that way. But if industry as a whole is going to get up a full head of steam in acquiring new knowledge, the impetus has got to come from big business which has the means to pay for it.

How can those who continually attack big business expect us to accept this new kind of risk if they keep us forever preoccupied with the effort to keep ourselves whole? This is simply not the way to get on with the vital tasks that we must get on with.

I hope I have made myself plain. I have said to you tonight, that we in the Bell System have found basic research essential to progress in one very important field. I have urged others in business to take note of the threat we all face and to accept whatever responsibility properly belongs with them in their fields. I have reminded members of government, finally, of their responsibility to allow us in business the freedom and the resources we need to do our job. For the stakes are high and they concern not any single group, but the welfare of the nation and of all free people.

Between Point Arena and Hanauma Bay twin cables stretch twenty-four-hundred miles, lying many fathoms deep and linking the Islands more firmly with the mainland

HOW THE TELEPHONE CABLES WERE LAID TO HAWAII

FRANK CAMERON

The author, a free-lance writer, gives us his view of the critical operation as seen from the deck of H.M.T.S. Monarch *on the voyage between Honolulu and California.* EDITOR

IT WAS, that vivid August morning of 1957, the strangest sight on Honolulu's waterfront. Berthed bow-to-bow alongside a pier lay two extraordinary ships, the exact like of which sailed nowhere else on the seven seas. The handsome grey 483-foot vessel with a long midships housing was *Her Majesty's Telegraph Ship Monarch*, the world's largest cable-layer. Feeding *Monarch's* great round abdominal cavities with a seemingly endless worm of meticulously engineered cable was the high-riding American explorer-supply ship *Arthur M. Huddell*. The transfer of cable from *Huddell* to *Monarch* in continuous flow was the semi-final step in the last lap of history's most ambitious submarine telephone cable-laying operation. This project is the new 2400-mile voice-way that now virtually guarantees dependable telephone communication between Hawaii and the mainland —come hell, high water, or sunspots.

I stood uncertainly at the foot of *Monarch's* gangway. Before me the ship's deck was a maze of wires, pulleys, transporter wheels, and running cables demanding so much attention from the ship's personnel, it seemed unlikely that I—and my perplexed questions—would be welcome.

"Don't be a coward," someone behind me spoke in a Scotch burr, so thick each word sounded muffled in tweed. I turned with a questioning look. The rich, heathery accent came from a round, bland face set in a big, well-padded frame.

"Cable Foreman McManus," the burr introduced itself in tones of dour amusement. "You're no credit to the ship standing there. Go aboard."

Once across the gangway I was assaulted by a medley of smells, by a touch of tropical dampness, and by the confusing sounds of a ship in the throes of sailing day. Before I had a chance to isolate and catalogue most of these sensations, however, we were departing outbound past the combers of Waikiki and soon rounded Diamond Head. Then, lightly buffeted by a brisk trade

Tucked into the protective hillside above Hanauma Bay, not far from Honolulu, is the terminal building, where the cables from and to the American mainland come ashore

wind, *Monarch* headed for the most implausible of rendezvous—two buoys 700 miles ahead in the vast Pacific.

In the shipboard office of J. Stirling Jack, Long Lines' project manager, I saw an immense chart that illustrated graphically how *Monarch* had already laid over 1700 (statute) miles of cable westward from Point Arena, on the coast of northern California, to a point in the Pacific within 600 miles of the Island of Oahu. There her supply had reached its calculated end and she was met by the British cable ship *Ocean Layer,* with full cable tanks.

Testing new equipment inside the terminal building before final cable laying begins

Splicing onto *Monarch's* last mile of armored wire, *Ocean Layer* finished the westbound voice-track by tying into the shore ends already laid off Hanauma Bay, near Honolulu. That meeting of cable ends, however, still left another half of the project to be done. *Ocean Layer* then about-faced to lay 750 miles of the return cable—

because some submarine telephone circuits, unlike the telegraph, require two cables, which handle traffic much as a divided highway. Placed roughly 25 miles apart in order that there be no mix-up in case of repair, these would comprise a $37,000,000 two-way transmissions system, providing 36 circuits for conversations, for radio programs, for teletypewriter circuits, and for other communication needs.

When the last mile of *Ocean Layer's* cable payed out (with the California terminal still 1720 miles to the east) the end was buoyed off; i.e., attached to a red, black, and yellow buoy the size of a couple of telephone booths.

Topped by a battery-powered light and a blue and yellow flag, the buoy was anchored in the three-mile depths of the Pacific to await *Monarch's* arrival. Five miles to the north of this, *Ocean Layer* anchored still another marker—a reference buoy. It might serve as a signpost should the first be lost or drift away.

It was toward these twin dots that we were now headed. If all went well, one or both would be there. If, as sometimes happens, they had parted from their mushroom anchors and drifted off, we would have to reckon where the cable might lie, grappling and dragging with special hooks until we found it.

For three days, loaded to our marks with 5290 long tons of cable—including 39 of the most intricately contrived amplifiers ever manufactured—we lumbered through the bucketing trades at *Monarch's* average cruising speed of 12 knots.

Transferring some 1500 miles of cable from S.S. Arthur M. Huddell *to* H.M.T.S. Monarch *was a delicate and time-consuming operation*

The Monarch's *fathometer records the configuration of the ocean bottom as the cable is payed out*

Then Saturday dawned, clear, with light airs. A sense of expectation came over the ship. The monotony seemed about to be broken just over the constantly retreating horizon—because this was the day *Monarch's* Captain J. P. F. Betson had predicted a 2:30 P.M. sighting of the buoys.

A half-hour before this, I joined the other "passengers" who were spotting themselves strategically on the upper flying bridge and in the wheelhouse just below. Besides Project Manager Jack, these included his lieutenants Ogden Gensemer and Frank J. Putallaz of American Telephone and Telegraph's Long Lines' Department; Walter Klutz, technical adviser from Bell Telephone Laboratories; Douglas Guild, operations vice-president of Hawaiian Telephone Company, whose organization is underwriting a share of the project's cost.

Picking up the buoy

When 2:30 had passed, the atmosphere in the wheelhouse became strained, the remarks few and subdued. Amidst the solemnity, *Monarch* bowed quietly to each wave, then lurched aside like a tipsy, amiable dowager.

At 2:52 P.M., light steps came hurrying down from the flying bridge. Fourth Officer David Alford entered.

"I saw it there not a moment ago," he reported with an air of repressed excitement. "Ten degrees on the starboard bow."

The words carried a light electrical charge. It had the excitement of a landfall after several weeks at sea.

Thanks to good weather and an experienced crew, the job of picking up the first big, bulbous marker was comparatively simple. With that accomplished, the cablehands began the tiresome work of hauling up and coiling down the three miles of stiff, thick steel rope that had moored the buoy to the bottom of the sea.

Along with this rope came little chunks of the ocean floor. It was dark grey-brown in color, odorless, and had the buttery feel of wet clay. Despite its earthly qualities, I

handled a small piece with the reverent curiosity I might have accorded a sample of Mars.

It was almost midnight, Saturday, before this buoy was lashed down and the long mooring line coiled on deck. Now before we could get under way with our two-weeks' mission, we had to steam five miles back to the more important buoy—that to which the end of the telephone cable had been tied and left by *Ocean Layer*.

By 6:00 A.M. Sunday, after a trying night of work, this buoy too was on board and the cable-end we sought had been retrieved. Two hours later the cable's end had been laid bare and run into the ship's testing room, where six testing engineers, directed by Frank Putallaz, began a series of routine checks. Their job was to make certain that all was well between this point and Hanauma Bay.

Almost surrounded by grey enameled banks of transmitters, dials, switches, and plugs, the testers set about their work.

"*Monarch* test room calling Hanauma Bay. *Monarch* test room calling Hanauma Bay," Putallaz' voice went out over a radio-telephone circuit.

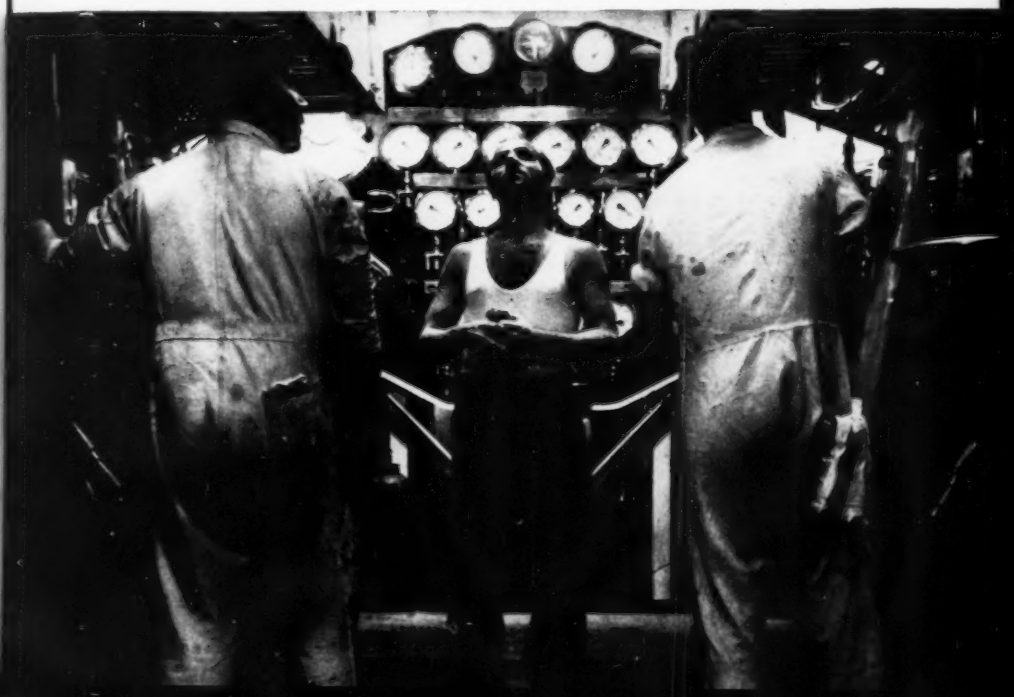
"Hanauma Bay here, *Monarch*," came the reply. "We read you good on this frequency. Come in please."

"Hello Hanauma Bay. You're coming in well here, too. Cable is now on board. We are proceeding with short circuit and open tests before applying power. Please stand by."

It was not precisely an historic message. Compared with the telegraph's "What hath God wrought?" or Alexander Graham Bell's first words, "Mr. Watson, come here. I want you," it might even be found wanting. Yet its significance was not lost on those on board—including Douglas Guild.

"I've lived this whole project," he said with feeling, "right from the discussion stages two years ago. It means a lot to us

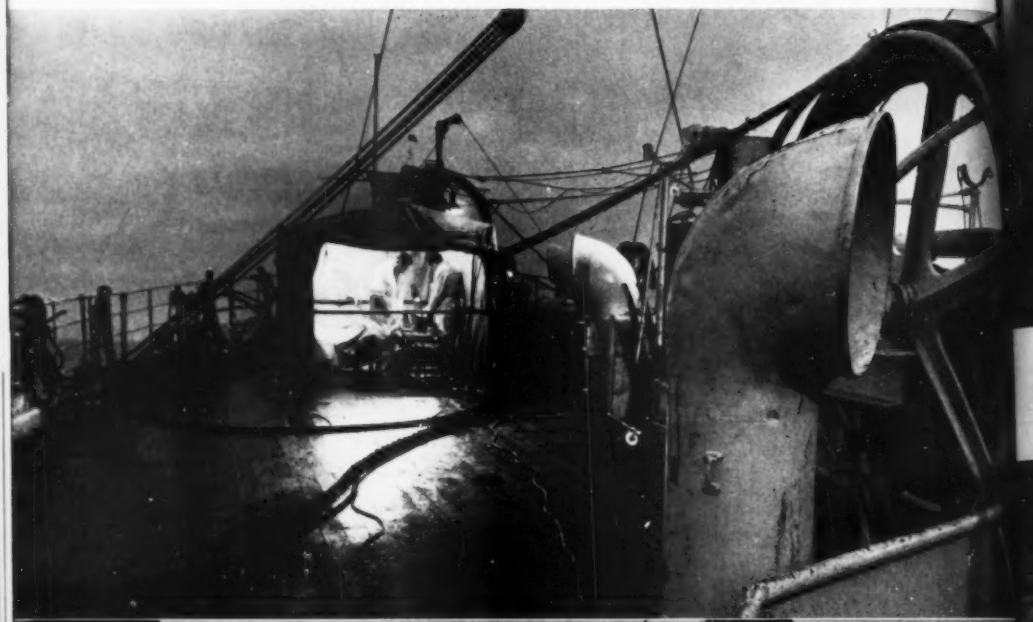
Harkening to the rhythmic beat of sounds in the engine room which tells watchers there that all's well below decks and above



Left: There's a special skill in coiling cable in the stowage tanks

Below: Climax of the voyage – the final splice. It began on the foredeck of the Monarch *late one night and was completed the next morning*

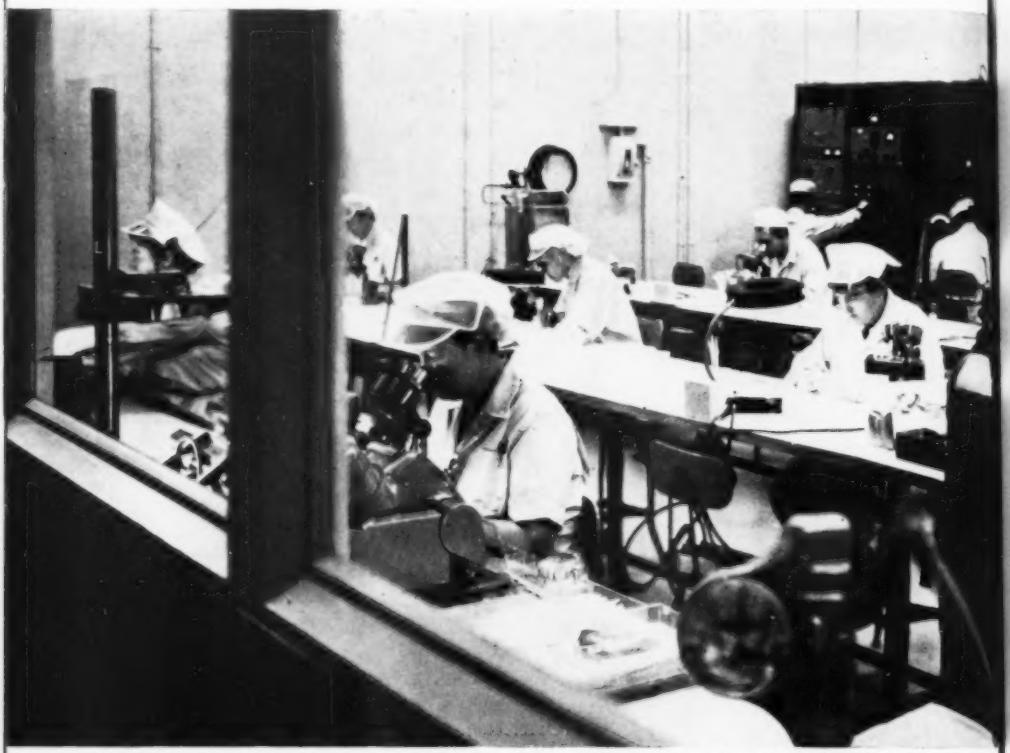
Bottom: Before it goes back to ocean's depths and routine transmission of messages, the splice must be armored with jute and heavy wires



Above: The final splice in the cable now completed, Hawaiian Telephone Company's Douglas Guild and Long Lines' Stirling Jack look on with Captain Betson as crew members prepare to lower away. Below: Critical moment: one of the repeaters goes over the big stern sheave

in the Islands; maybe because it ties us more closely to the mainland.

"There's a security angle to this too," Guild went on, "The U.S. Defense Department has asked A. T. & T.'s Long Lines Department and our company to get the job done as soon as possible. Now Honolulu operators will be able to dial directly into the homes in 6,500 mainland cities and towns. It works the other way, too, so you can see a new era in communications is beginning for us."



This laboratory-like shop area of Western Electric's Hillside building is supplied with filtered and humidified air under pressure, to meet rigid specifications for cleanliness

Repeaters: the essential element

THE TRICK that will make this new era possible is the telephone cable's built-in "booster" (called a flexible repeater). We carried 39 of these intricate amplifiers on board. Such devices are not necessary for telegraph wires, which have been spun out beneath the seas for almost a century. A voice message, however, fades out at approximately 70 miles. To compensate, the telephone cable has a repeater about every 40 miles. There are 114 in the two Hawaiian cables and each amplifies the voice a million times; 39 of these were now ours to lay.

"Just to give you an idea of their importance," Walter Klute, Bell Laboratories' stocky, crew-clipped technical advisor on board, explained, "let me tell you the

pains that have gone into making them. Without exaggeration, I think I can say nothing closer to perfection has ever yet come out of a factory. Out of a laboratory –perhaps–but I doubt if you can match the story of these repeaters anywhere else in the history of American manufacturing."

When the success of the Havana-Key West project was assured, Bell Laboratories turned the repeaters over to Western Electric for production.

"Here," said Klute, "a whole new philosophy of manufacturing was set up. No longer was the objective just a quality

Another scene in the Hillside shop: Joints in the flexible repeaters incorporated in the cables must be absolutely tight: impregnable to air and moisture

The repeaters, as Klute described them, had been devised in the Bell Telephone Laboratories between 1929 and 1941 and first used in the Havana-Key West telephone cable. This was laid in 1950. It became the prototype of all American undersea telephone systems, which, to date, far surpass those of any other country in scope and excellence.

product turned out on an assembly line. We wanted perfection—nothing less. Time meant little; skill, precision, and pride in workmanship counted for everything. Western Electric built a new factory at Hillside, N. J., with exactly this in mind. Two hundred employees were screened just to give the finest possible results. The slightest imperfection in any part of the

repeater was cause for rejection even though we knew that component might work. Our repeaters have to stand some of the severest strains a man-made thing might be subjected to—and yet last at least 20 years."

Extreme Precautions

THE EMPLOYEES in the Hillside factory work under conditions of clinical cleanliness. They wear special orlon uniforms and special shoes with lasts that prevent dust-catching. Perspiring hands are sheathed in orlon gloves. Women wear no powder and no nail polish. The factory's dust-free air is sampled continuously for tell-tale particles, lest small deposits become sealed in the parts and cause trouble.

The 60-odd components of each repeater, once assembled, look like 17 sausages in a link. "Of these elements," Klute said, "perhaps the most interesting are the vacuum tubes. In principle they're like those in your radio or television set. However, these aren't produced in the factory but in the laboratory.

"Each tube that goes into a repeater has a twin that is withheld. Both are subjected to 5000 hours of initial testing before they go their separate ways. The tube *not* slated for repeater use stays in the laboratory, where it is tested continuously. That gives us a clue as to how those in the cable are holding up. In the Havana-Key West project, some of the 'sister tubes' have been under test now for about 18 years—over 150,000 hours!"

But the miracle of the repeaters does not end at the factory. From Hillside, N. J., pairs of them are shipped by truck in rubber-cushioned aluminum cases to Simplex Wire and Cable Co. at Newington, N. H. Each foot of the 250-mile journey between Hillside and Newington is carefully inspected for shocks and bumps. A driver must report in by telephone every 30 miles in order to check his speed and get a report on road conditions ahead.

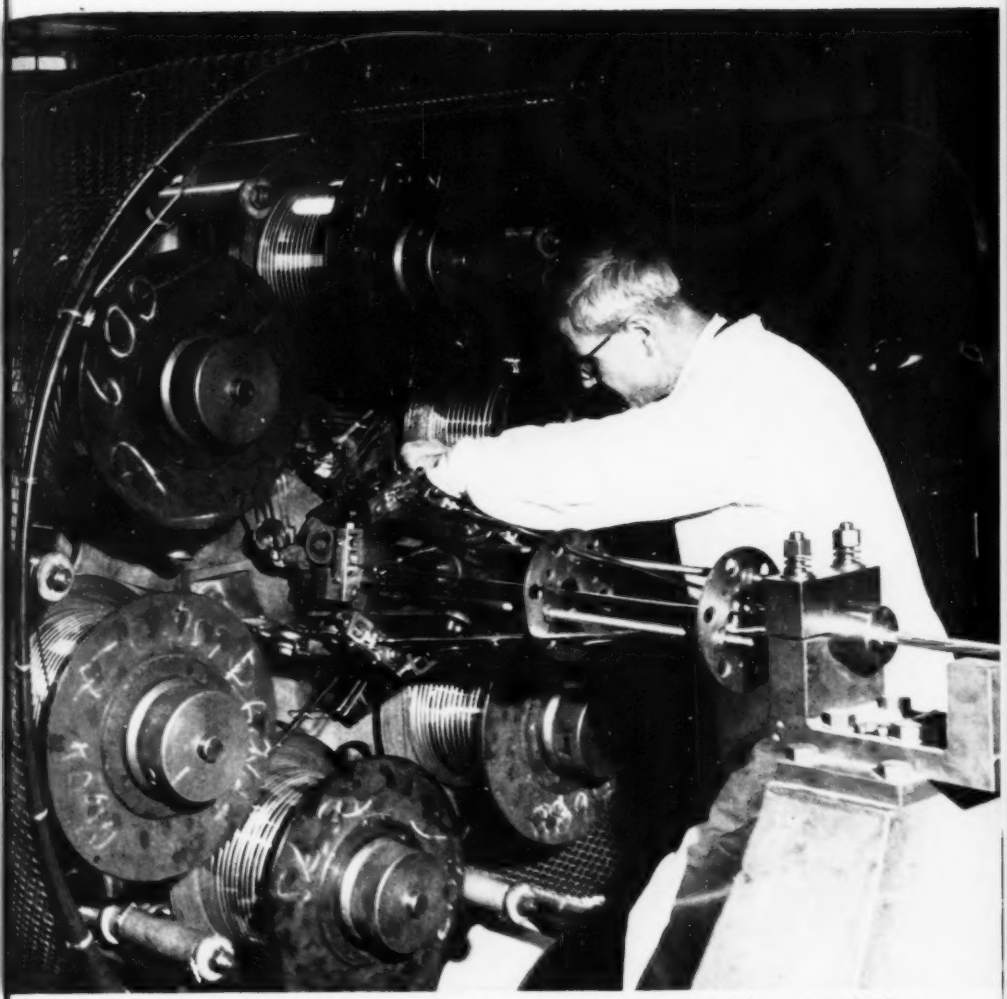
At Newington, the repeaters are armor-plated with thick, rod-like wires. Half of them remain at Newington, where they are joined into the regular armored telephone cable. They then become—with their tapering leaders necessary for splicing—a slightly thicker yet still flexible part of the continuous cable. "Like sort of a country village," Klute put it, "they're just a wide place in the road."

The other half of the repeaters—still under the same infant-like care—are trucked to Idlewild Airport, Long Island, and placed aboard London-bound planes. At Erith, on the Thames, these are laced into that half of the cable produced at the Ocean Works of Submarine Cables Ltd., a long-established British firm.

Making ends meet

MEANWHILE, on board, there was still a sizeable job to be done before we could actually get under way. We must splice the first block of *Monarch's* cable to the end we had retrieved from the buoy. This would be a six-to-seven-hour operation that had been postponed until the decision to proceed had been settled.

While most of the rest of the ship slept, the jointers molded together the thick polyethylene coating around the cable's actual voice conductor—a one-eighth inch copper core. Once cooled, the new joint was x-rayed for flaws. Then the splicers took over, weaving armor wires, copper tapes, and outer jute covering into a smooth, continuous whole. Now *Monarch* was ready to start her spidery work of spinning an endless black thread. We were no longer a free agent. Unlike other ships,



On whichever side of the Atlantic it is performed, manufacture of submarine telephone cable is an exacting operation, calling for a high degree of skill and years of experience

Monarch was now tied to her task until the last splice would be joined off California.

We began this productive lap of our voyage with No. 1 tank. From it the cable unwound around a central cone and sped up and out of the tank in a graceful S as though part of an endless Hindu rope trick. Once above deck, it began its smooth flight through 35 pulleys down the long center-castle of the ship, a wide passageway flanked by rooms on each outboard side.

On the open after-deck, the cable passed over two 7-foot wheels, then dived down to circle a huge cable-engine drum to check its speed. Once it survived the stress of this, it wound over the dynamometer wheel, which measures the tension, then

Point Arena's terminal building stands beside the radio relay towers which send and receive signals to and from Oakland and the Bell System's nation-wide network

passes over the big stern sheave before paying out into the Pacific. Without the strong snubbing action of all this mechanism, the pull on the cable as it sinks would carry it out at tremendous speeds – with disastrous results.

On the after deck, one day, I watched the ritual of a repeater's passage. This occurs every seven hours, and always present at these 38-mile interludes are the captain, Stirling Jack, and a small group of officers and men. Nothing, their presence seems to say, must interfere with the smooth transit of a repeater from cable tank to ocean.

During this operation, the ship cuts its 6-knot speed in half, and to make certain the repeater's transit is properly carried out, there is a red-yellow-green signal, like a traffic light, supplemented by a system of sirens and loud speakers between the after deck (also called the stern sheets) and the tank forward from which the cable is coming.

As the moment for the repeater's arrival approached, the dialogue and actions of the cast took on the rigidity of a Japanese *No* drama. The loudspeaker gave a warning buzz, signaled by the watchman stationed on a gallery in the cable tank.

"Stern sheets," acknowledged the cablehand charged with relaying the message.

"One half mile to go," the tank watchman announced.

"Aye, one-half mile to go," the cablehand parroted in a voice loud enough for the captain, Stirling Jack, and the officers to hear.

The minutes passed. The cable payed out more slowly as the ship slackened speed.

Again the speaker buzzed.

"Twenty outside turns," came a hollow resonant warning from the tank.

"Twenty outside turns," the cablehand dutifully repeated.

At the cry "Ten turns!" the green light flashed to amber. A siren screamed. A sense of expectancy, a heightened moment so easily achieved in horizons bounded by dead routine, followed.

"Five turns!"

The Captain spoke. "Easy ahead, both engines."

An officer signaled the command on the engine-room telegraph.

"Repeater lifting!" the tank announced in its distant voice.

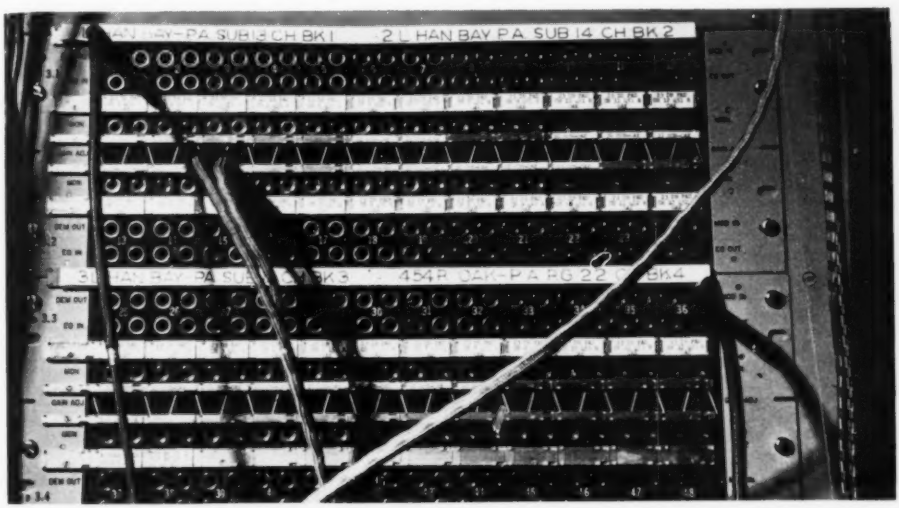
"Hard-a-starboard," ordered the Captain.

"All clear of tanks!" came the word.

The light flashed green.

Now the repeater was on its way. The instrument that had taken over ten years of research and development to make surpassingly strong, flexible, and effective was about to undergo its severest test. We watched this "wide place in the road" emerge from the center castle slowly. Except for the fact that it was as thick as your forearm, there was little to distinguish it for forty feet from the 1¼-inch cable that preceded and followed it. Yet it was the prima-donna of this strange five-a-day maritime show.

Around the cable engine drum it went four times under 4½ tons' braking tension. While the untrained onlooker might have expected its sausage-like tubes and components to crunch under such stress, the repeater passed smoothly and quickly over the stern sheave and slipped noiselessly beneath the surface, with only a feathering of the water to mark its passage. Somewhere astern—perhaps 12, perhaps 18 miles from where we stood—it would drop with its connecting cables, gently, noiselessly, under 8000 pounds' pressure per square



Where continent and ocean join. The rows of double jacks numbered from 1 through 36 represent the channels over the newly laid submarine cable. The other channels are from the Point Arena terminal building to Oakland, where they join the country-wide Bell System network

inch, onto the near-freezing ocean floor.

By Tuesday, September 3, *Monarch* was rolling ponderously along in an oil-slick sea. As one block of cable was powered and layed, jointing and splicing operations were constantly readying the next. The cable spun out with the fluid ease of a swift tide, and *Monarch* settled down to watch and watch, meal after meal, a day and night routine. The turning wheels, the recurring tasks, the launching of each repeater gave life aboard ship a strong feeling of rhythm.

Cable laying: art and science

Now *Monarch's* officers could take time to talk about their calling. Theirs is an unusual vessel engaged on an unusual service. With the possible exception of whaling, no other peaceful seafaring occupation demands such special training and talents. Said Captain Betson: "There are no schools and no textbooks to give you the rules. There's only one way to learn cable-laying —experience."

One man aboard who represented the cable-laying tradition was the ship's chief testing officer, Ernest Willoughby. Over 90 years ago his great uncle, Willoughby Smith, sailed on the "great iron ship" *Great Eastern* in 1866, when she laid the first successful trans-Atlantic telegraph cable, under the sponsorship of Cyrus Field. Willoughby Smith's job then: chief testing officer.

The hazards to cables, I was surprised to find out, haven't changed greatly since 1866. In 1929, one submarine landslide (called "turbidity current") swept away most of the North Atlantic telegraph cables in the vicinity of Newfoundland. Marine clams, called *toredos*, can bore into cables not protected by special copper sheathing. Fishermen in trawlers drag their nets with otter boards that often snag and break the older cables as they scrape along the bottom.

"As a matter of actual statistics," Stirling Jack told me, "there is eight times as much trouble in shallow water as in deep. That's why when we approach the shores we change from this cable into one more heavily armored; from 1¼-inch in diameter to 3-inch. Right here in mid-ocean is where the cable's safest."

As we proceeded, the ocean's bottom was constantly being probed by two fathometers on board. A fathometer measures this distance between ship and ocean floor by sending down a series of electrical "pings" continuously. The time before the echo bounces back, traveling at the rate of about 4800 feet per second, is recorded in fathoms and a stylus pens the results on a moving roll of graph paper.

In 1956, to get an accurate picture of what the Pacific's bottom might be like, Long Lines fitted out the ex-Liberty ship *Arthur M. Huddell* with special equipment, including a precision depth recorder—a more accurate type of fathometer. With it, the *Huddell* made a round trip between Point Arena and Hanauma Bay, discovering *en route* an unknown 11,000-foot underseas mountain—about the size of Oregon's Mt. Hood.

Around Mt. Huddell, *Monarch* now made a cautious detour in order that our cable would avoid the mountain rather than surmount its peak. Still following the *Huddell's* recommended course, we came, on September 5, to the region known as the Moonless Mountains. These were discovered only two years ago and their Sierra-size peaks seemed to resemble the African Mountains of the Moon. Here, again, the *Huddell* criss-crossed the region to find a course through the underseas rampart that

would allow our cable to drop across gentle hills and through long valleys.

Beyond the Moonless Mountains lay still another hazard – the Murray Fracture Zone. This is over 1200 miles long and has a depth of four miles in places. To cross it at its deepest cleft would be like laying a cable across the desert and then suddenly plunging into the Grand Canyon. But the *Huddell* had found a practical by-pass, which *Monarch* followed in order to give the cable the smoothest possible lay.

Once we left the Murray Fracture Zone behind, the rest of the Pacific floor seemed not much rougher, according to our fathometers, than New York's Fifth Ave. By midnight, September 11, we had arrived ten miles off Point Arena on the wildly beautiful Mendocino Coast of northern California. Here lay the mainland shore-end where we would connect into the 130-mile radio relay route into Oakland.

The shore stations for this project, both at Hanauma Bay and at Point Arena, were selected with extreme care. Hanauma Bay won out over seven other sites on the Island of Oahu as comparatively safe from both hostile man and nature. This shore station is built into a hillside high above the beach, where it has natural protection from enemy air attack. Its location on the Bay—the picturesque crater of an extinct volcano—was also chosen with an eye to avoiding the full effects of the "tsunami". These enormous waves build up from underseas disturbances and sometimes beat against Hawaii's shores at a speed of 500 miles an hour.

The Point Arena site was chosen no less judiciously. A deciding factor here was California's nervous San Andreas fault—the earth slippage that caused the 'quake of 1906. Lest another such shock should sever the cables, Long Lines' engineers selected Point Arena because it was one of the few patches of land north of San Francisco lying to seaward of the fault. On the landward side, the circuit relies on

At Erith, not far from London, cable is loaded aboard the Monarch

radio telephony, unlikely to be affected by quakes. But by selection of this site, the chief problem of terminating the cable before it crossed the fault had been solved.

This terminal, like that at Hanauma Bay, was already built and its shore ends placed months before the ship-laying phase of the operation even began. In fact, the Point Arena job, in April, 1957, used up about all the tricks of Long Lines' outside plant engineers. There were cross-currents, pounding surf, undertow, and storms to battle in getting the shore-end cable from barge to land. A rubber raft carrying the end in, foundered. When shot from a Lyle gun, a pilot line fell short of the beach. Finally, a helicopter successfully brought in a towline, and a tractor then heaved in the cable through a deep sandy trench to the station.

This was the prepared terminal at which we arrived on that moonlit night of September 11. In the clear weather we found the shore-end buoy without trouble. The word of its sighting passed through the ship faster than our seven-knot speed. As the last turns of the cable unwound, the spirits of the cablehands on watch in the tanks ran high. From out of the emptying void of Tank 4 came a gusty rendering of "It's a Long Way to Tipperary."

All through the night the jointers and splicers worked over that one last connection as we lay hove to. By noon the next day, September 12, the finished splice was dropped over the side and onto the relatively shallow Continental Shelf.

"There she goes!" cried Stirling Jack as the cable hit the water with a loud splash. Then he turned to the crew. "Well done, men," he said quietly.

Behind us we had left nine million feet of cable payed out in less than ten laying days. From the crater of an extinct volcano to a point just short of America's most notorious earthquake fault, the long underseas telephone circuit to Hawaii was now complete.

The integration of manufacture and supply with research and operations plays an important role in providing Bell System service

WESTERN ELECTRIC'S PART IN TELEPHONE SERVICE

ARTHUR B. GOETZE

President, WESTERN ELECTRIC COMPANY

HERE ARE A FEW figures that tell a story important to every telephone user.

Had Western Electric billed its 1957 sales to the Bell System at end-of-1950 prices, its charges would have been about $175,000,000 higher than the $1,821,000,000 they actually were—this in spite of the fact that Western Electric's 1957 labor and material costs were higher by about $275,000,000 than they would have been at 1950 wage and material cost levels.

I know of no comparable manufacturing concern anywhere which, in the face of the riptide of inflation, of soaring labor and material costs, has been able to hold the line on cost of production as we have done. Large volume and more economical designs contributed to the accomplishment, of course. A substantial part of the achievement, though, must be ascribed to the unceasing effort, pervading every Western Electric organization, to pare the cost of production at the same time that we advance the quality of our product and the efficiency of our services.

The consequences to the Bell System are obvious. In the absence of these economies, the pace of growth and improvement in Bell System service might have been seriously retarded or, alternatively, the Bell System earnings so vital to stimulating new investment for future growth might have been impaired. It is no boast but rather a matter of sober fact that America's telephone system—its physical plant so largely a product of Western Electric people—could not have developed its present ability to serve the public so well were it not for the effective integration of the Bell System's research, manufacturing, and operating units.

The standard of service to which Western Electric aspires places equal emphasis on the elements of quality and cost. Our goal is the System's goal: high quality telephone service at costs to the public which are reasonable and which encourage expanding use of the service. It's Western Electric's job to deliver the best possible product, built for long serv-

Western Electric people, like the telephone company people who employ the materials W.E. makes and buys, have a continuing responsibility for the achievement of Bell System service goals. Here W.E. installers ready an Indiana central office for service.

ice life with a minimum of maintenance, at the lowest possible cost.

To cite an instance—the 416 planar triode, an electron tube essential to the operation of Bell System microwave systems, sells today for about one third of what it sold for in 1951. Furthermore, improved design and improved manufacturing methods, growing out of the joint efforts of Bell Telephone Laboratories and W.E. engineers, have multiplied the tube's effective life sevenfold in the same period. Thus today the 416 tube costs—per service hour—less than one-twentieth of what it cost a few years ago.

Another example: The wire spring relay operates two to three times as fast as the older types it replaces. During its anticipated service life it is expected to operate without adjustment through 100 to 200 million operations. But none of these advantages, inherent in the design of the new relay, could have been achieved in service unless W.E. engineers and shop people could find a way to make it with the extreme precision specified and do so at a reasonable cost. They did. The manufacturing process they devised makes extensive use of automatic facilities. The machinery and tool investment is high. But

the product, vastly improved as it is in performance and service life, actually costs less than the product it replaces.

Production economies like these have helped to make telephone service the "better bargain" it is today, have materially helped to bring service within the reach of more and more Americans.

A national asset

BECAUSE OF THE capabilities Western Electric has developed to do its telephone job, the U.S. Department of Defense has found the company uniquely qualified to undertake a number of military projects of broad scope and great complexity. The DEW Line is an example. The dramatic story of the building of this Arctic radar net has been told and retold, but I should like to add the testimony of my own observation to the tributes already paid to the men who did the job. The more than two score radar-equipped sentry posts across the northern rim of the continent testify to the technical and logistic skill —and yes, to the courage—of the Western Electric and other Bell System people who, together with hundreds of sub-contractors, met this massive challenge and mastered it. What is more, the job was completed on schedule in just 32 months.

Again, it was precisely because of Western Electric's experience on the telephone job—and as a consequence of the integration of its operations with those of the Bell Telephone Laboratories and the telephone companies—that the company was asked to undertake the management of the vital Sandia Laboratories for the Atomic Energy Commission, the coördination and engineering supervision of the SAGE system, and the construction of

Here appear some of the largely automatic facilities W.E. developed to make the wire spring relay, a product required by the millions each year and yet calling for precision of the highest order

Alaska's White Alice communications network. The guidance systems of the Nike missiles standing guard around our cities are still another product of the integration of Bell Telephone Laboratories research and Western Electric experience in the production of precision electronic gear. The experience gained in the design and construction of Nike is even now being applied to the guidance systems of the more advanced types of "hardware" appropriate to the challenge of a tomorrow that may already be upon us.

The scope and significance of its defense responsibilities point to the Western Electric Company as a major national resource. We did not seek those responsibilities, proud as we are that we have been chosen to undertake them. They are ours because of a long record of performance on large-scale projects of great technical complexity, bridging the gap between research and operation. Serving the Bell System is our job; serving the nation is our duty. The one grew out of the other.

The responsibilities of enterprise

But if Western Electric's resources and productive capacities are an asset in the context of national defense, are they equally so in the context of the domestic economy? Americans have the right to ask, to assure themselves that this or any other enterprise of commensurate economic significance is being operated responsibly in the public interest. To that end, Western Electric is effectively, if not directly, regulated through the continuing scrutiny of its prices and profits by national, state, and municipal commissions whose duty it is to review telephone rates. At the hearings of these commissions, Western Electric representatives testify fully and freely.

Western Electric's return on net investment applicable to Bell business has averaged 8.2 per cent (compared with 10.6 per cent for the 50 largest U.S. manufacturers) over the past 32 years. Our net profit has averaged 4.1 per cent of Bell sales over the same period. By contrast the profits on sales of the 50 largest manufacturers in the U.S. have averaged half again as much. Western Electric's relatively low earnings reflect the public service nature of our business: the concern we share with our telephone company partners for offering to the public a good service at prices which are as low as they can reasonably be.

33,000 partners

Scrupulous concern for the lowest possible cost compatible with long-run serviceability governs Western Electric purchasing operations as stringently as it does our manufacturing. And the consequences to the telephone companies—and to telephone users—are equally significant. Approximately 50 cents of the Western Electric sales dollar goes for things we buy from other companies.

In 1957, Western Electric purchases amounted to some one and one quarter billion dollars. We bought from some 33,000 different suppliers—ninety per cent of them small businesses (employing less than 500 people)—in all the 48 states and a number of foreign countries.

Western Electric buys raw materials for its own manufacturing operations – the copper and steel and the other metals and plastics it fabricates into instruments of telephony. Purchases also include components, sub-assemblies, and complete assemblies for incorporation in W.E.-manufactured products. And W.E. buys supplies and special equipment in the

telephone companies' behalf—paper and paper clips, climbing irons and telephone poles—providing the Bell System operating units the economies to be derived from bulk purchasing and the wise shopping of a centralized buying staff experienced in the world's markets.

Western Electric buys a good many products we could make ourselves in our own shops, many of them products we actually have manufactured at one time or another. The decision to buy rather than make is based on W.E.'s fundamental tenets of service—quality and cost. If a supplier can meet Bell System specifications, if his price is right, and if he is ready and able to deliver the goods on time in routine or emergency, he gets the business. Western Electric is thereby relieved of the necessity of doing jobs that someone else is specially equipped to perform. And when Bell System requirements exceed Western Electric's capacity to produce, W.E. looks to outside suppliers to help meet telephone company needs even though somewhat higher costs are entailed. In the last couple of years, for example, we have purchased substantial quantities of exchange cable from suppliers here and abroad. In this and like instances, Western Electric has been unstinting in its efforts, through technical assistance, to assure a quality product.

Technical assistance to suppliers works not only to Western Electric's advantage and the advantage of the telephone companies we serve but to the supplier's own advantage as well. In many cases W.E. buyers and engineers provide technical assistance which not only improves the quality or cuts the cost of the products

The electroforming mill at Point Breeze for the production of copper coated steel wire is an outstanding example of automation on a major scale.

we buy but also introduces new efficiencies into the supplier's operations which benefit other customers. And the effort is reciprocal; imaginative and technically aggressive suppliers frequently contribute ideas which pay off for us in production or operating economies.

Joined with the people of Western Electric through bonds of fair and aboveboard dealings, W.E.'s 33,000 suppliers, employing more than 5,000,000 people are partners in the job of supplying the Bell System; a job Western Electric cannot undertake—and does not aspire to undertake – alone. Dispersed throughout the nation, experienced in meeting the Bell System's service requirements, W.E.'s suppliers and sub-contractors represent a vast production potential which, through the coördinating activities of Western Electric's purchasing staff, can be deployed swiftly and effectively to meet emergencies or mobilized for major national defense responsibilities. Less dramatic but nonetheless significant is their contribution to the everyday telephone job. We count their skills—and their good will—among the major resources of the Western Electric Company as it readies itself for the task of building the telephone system of tomorrow.

The technical challenge

WESTERN ELECTRIC is working on tomorrow's technology today. So swift is the current pace of technical change that I for one would hesitate to predict the shape of Western Electric's production lines a decade hence. Trends, though, are discernible. The principles of automation, for example, have already been widely applied in Western Electric. The electro-

"Western Electric is working on tomorrow's technology today." W.E.'s new graduate engineering training program is designed to equip and inspire W.E. engineers to new advances in production technology.

The Department of Defense has found Western Electric uniquely qualified to undertake military projects of broad scope and great complexity. The DEW Line is an example – a ***massive*** *undertaking completed on time in 32 months*

forming mill at Point Breeze for the production of copper-coated steel wire is an outstanding example of automation on a major scale. Scores of other major developments already under way promise to extend the economies of automatic manufacture to large areas of our operations, both mechanical and clerical.

Increasingly, it appears, the pace of telephone progress will depend on the readiness with which the fruits of communications research can be translated into terms of quantity production. Increasingly, too, process considerations are coming importantly to affect product design. Indeed, it is already apparent that the potentialities and limitations of production processes can be the most important factor in determining whether or not a newly conceived product will find its place in telephone service. Thus the traditional shoulder-to-shoulder working relationships of Western Electric and Bell Telephone Laboratories scientists assumes a new importance in meeting the needs of the operating telephone companies and the public they serve.

To bridge the gap between development and production, to speed the essential process by which today's "bright idea" becomes tomorrow's service betterment, the Laboratories are extending and strengthening their resident contingents in Western Electric plants. This is good. I for one am certain that without the unique bond between the research and production units of the Bell System the high quality, low cost telephone service

our nation enjoys could not have been achieved.

To supplement the engineering activities at its various locations, Western Electric is establishing a new research center near Princeton, New Jersey. Convenient to the Bell Laboratories at Murray Hill, it will undertake the same basic approach to the development of process that the Laboratories devotes to the development of product. The new engineering center will serve also to provide effective coordination of the engineering activities carried on at our many operating locations. This function assumes added importance in our increasingly decentralized company.

Perhaps an even more fundamental preparation for tomorrow's technology is being undertaken, not in Western Electric engineering offices and laboratories, but in its classrooms. Within the past year the company has inaugurated an extensive graduate engineering training program designed to equip and inspire Western Electric engineers to accomplish new advances in production technology surpassing anything we have known in the past.

The wide application of Western Electric and other Bell System engineering developments to outside industry is one more evidence of the vigor and creativity of telephone technology. The inventions

Besides providing warehouse facilities, W.E.'s 32 distributing houses operate repair shops where used telephone apparatus is restored to "like new" condition.

XUM

Of W.E.'s 135,000 employees, 42,500 have been with the company more than 10 years, 13,200 more than 25 years. Their experience is the company's richest resource.

made available through more than 1000 licensing agreements with some 700 different companies have provided them with important "seeds of technology." Over and above the stimulus to other industry these activities provide, they represent a contribution to the general advance of technology, and in the long run will serve to nurture new advances in our own engineering activities.

Building for tomorrow

Nineteen fifty-eight finds Western Electric in the midst of a large-scale plant construction and modernization program which calls for big new factories in Omaha, Columbus, Oklahoma City, and Kansas City, and new distributing houses in Charlotte, Washington, Detroit, and Westchester.

Why is W.E. building? Telephone company people familiar with Western Electric's role know the answer: the better to serve.

Designed for tomorrow, Western Electric's new plants will be able to accommodate processes embodying tomorrow's technology. They will permit us to achieve new levels of efficiency impossible under the "crash" programming imposed by the mounting pressure of demand that has been with us, virtually without let-up, since World War II. Even today, a dozen years later, we are operating in upwards of 12 million square feet of rented space, much of it not well suited for our operations. Our new facilities will give us the capacity to meet the demands of the years ahead on a more normal—and therefore a more efficient—basis than has been possible in these hectic post-war years. They will permit us, too, to accelerate the ad-

Designed for tomorrow, W.E.'s new plants and distributing houses will permit the company to achieve new levels of production efficiency

vances in efficiency and productivity that have characterized the company's performance through the years.

Thus W.E.'s current construction program constitutes a major element in the company's continuing quest for improvement of process, and reduction of production costs.

The forward look

In terms of products and facilities for their manufacture, the Western Electric Company of a decade hence may be quite a different company from what it is today. If the changes that have taken place in the last 10 years offer any criteria, it certainly will be. Essentially, though – in motive and purpose – it will remain the same. Progress in Western Electric, as throughout the Bell System, is measured in terms of expanding the opportunity to serve. And, like Bell System people everywhere, W.E. people know that telephone service will continue to grow so long as telephone users find it increasingly useful–a better and better bargain. We know that to the degree that we contribute in the years ahead to the job of building better instruments of telephony at the lowest cost human ingenuity can achieve, we will contribute to the well-being of our industry and to our own progress.

A guest editorial

NATIONAL DEFENSE IMPOSES GREAT RESPONSIBILITIES

GEORGE M. DEAN

Vice President and General Manager, NORTHERN CALIFORNIA AREA,
THE PACIFIC TELEPHONE AND TELEGRAPH COMPANY*

"In a world shaken by a fearsome conflict in ideologies, the long record of Soviet-sponsored espionage requires that we identify and apply the measures necessary to protect the secrets of our national defense" writes Jerome D. Fenton, director of the Office of Personnel Security Policy in the Department of Defense.

"No nation in modern history has placed so high a premium, or expended so great an effort, in plotting espionage and organizing treason as has the Soviet Union," he continues. "No nation has felt so impelled to base national policy on conspiracy and treachery."

The Bell System does a tremendous amount of work on national defense.

We *must* keep our own house in order, to make sure that vital communications services will be maintained in the event of war. In keeping with our tradition of "the message must go through," these services may well mean saving not only our country but our lives and those of our loved ones.

Work is progressing on the SAGE air defense system, which will tie radars and weapons together through a chain of electronic computing centers. This will use great quantities of interconnecting circuits supplied by the telephone companies.

The Bell Laboratories are continuing to work on military communications, guided missiles, and new electronic devices for defense. They also have a major part in developing guidance systems for the Air Force's intercontinental and intermediate-range ballistic missiles.

Western Electric Company is producing NIKE missile systems in quantity, including the latest long-range types. It has finished building the Distant Early Warning (DEW) Line across the top of the world, and in Alaska its "White Alice" communication network is scheduled for completion this coming Spring.

In New Mexico, Western's subsidiary, the Sandia Corporation, continues its management of the Sandia Laboratory of the Atomic Energy Commission, which designs, develops, and tests atomic weapons.

Many thousands of our telephone em-

*Mr. Dean contributed this guest editorial while he was assistant vice president in the Department of Operation and Engineering of the A. T. & T. Co., before he left on November 1, 1957, for his present position with the Pacific Company. EDITOR

ployees have been cleared by the Government and are at work on these and other projects—projects involving the need to know secret information. These men and women are well aware of the importance of their work, and the need for taking every precaution to protect the materials they work with from unauthorized hands and eyes.

Keeping mum about our work actually is foreign to our way of doing business, we must admit. In an industry like ours, that depends so much on teamwork, we have historically talked out our problems with each other. Yet, in our role in national defense, each of us who works on classified matter must ask himself—or herself—whether the other person has the right and the need to know what we are working on, and whether he or she has the proper security clearance.

In assigning defense projects, the Government has sought out and selected those companies and organizations that can best do the job. It is a tribute, indeed, to the character, integrity, and ability of telephone people that Uncle Sam has given us such a large share in his defense preparations.

In return, we shall continue to guard against the careless act or the thoughtless remark that might betray this trust.

Magazines and bulletins inform all Bell System people of company policies, problems, and progress through the "special authority of the printed word"

EMPLOYEE PUBLICATIONS HAVE WIDE READERSHIP

R. IRWIN JOHANNESEN

Publications Manager, PUBLIC RELATIONS DEPARTMENT, A. T. & T. CO.

ONE APRIL DAY fifty-five years ago in Nashville, Tennessee, a modest little magazine made its bow before a presumably expectant audience. It was Volume 1, Number 1, of the *Cumberland Telephone Journal*—eight pages and cover in size. Its audience was the employee body of the Cumberland Telephone and Telegraph Company.

This event, inconspicuous enough at the time, had far-reaching implications. The Cumberland company later merged with Southern Bell, and the little paper of 1903 grew up to become the *Southern Telephone News* of today, giving that flourishing periodical the distinction of being the Bell System's oldest publication.

Other System companies soon started magazines. The Pennsylvania, Indiana and Michigan companies started publication two years later, in 1905. The Mountain States and Wisconsin companies joined them in 1906; New England, Southern New England and Pacific in 1907.

Thus nine of our 23 Bell System employee magazines have been in business for over half a century and twelve of the remaining fourteen are over thirty years old.

The printed word—as exemplified by the magazines—was our first formal means of communicating with our employees. Face-to-face communication between supervisors and their people has, of course, always existed. So have employee meetings. But it is doubtful whether there was any such programmed use of two-way oral communications in the early 1900's as there is now. And certainly there was no competition from movies and slide films until much later. So the magazines had the whole employee information field to themselves—and covered it quite nicely, too, thank you!

"The printed word," as a prominent advertising man said recently, "has a special authority in our society, and by long heritage carries an authority lacking in spoken communication." "The Printed Word is the Word that Lives" is a slogan frequently

seen of late, and the *Atlantic Monthly*, noting in its centennial number how its circulation has grown despite TV, Radio, and movies, says it addresses itself to those "people to whom the printed word is still the most powerful medium for imparting the truth and for penetrating to the heart."

Whether or not you subscribe to these sentiments may depend upon your special interests in communication. Much evidence is available that many Bell System people prefer to learn about important company matters from the lips of their supervisors or in group meetings where they can talk things over. But this doesn't alter the fact that employees rate the publications high among their sources of news about the business. They like them, welcome them, read them, and *believe* them.

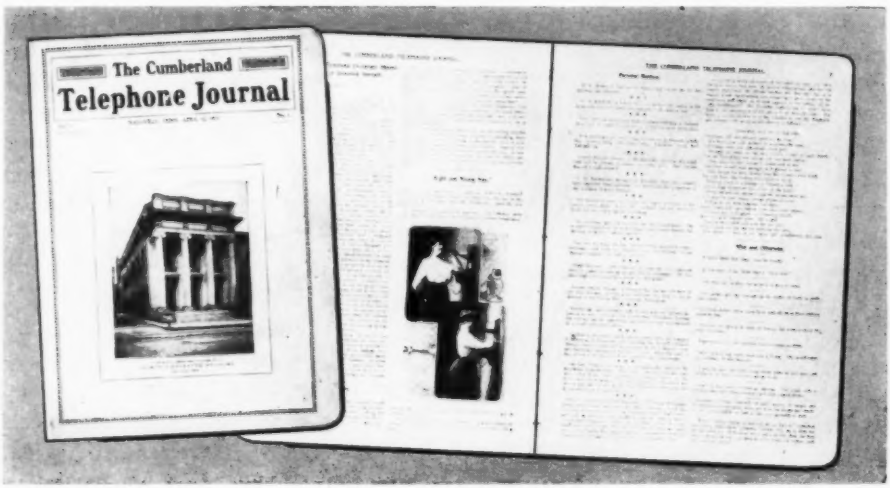
Probably the most effective employee communications set-up is a combination of the spoken and the written word—and that is the way we do it now in the Bell System. We use the spoken word for personal impact and discussion, the written word for permanence and that special kind of conviction that comes from seeing a thing with your own eyes on a printed page.

In any event, the System has never been a greater user of printed media than it is at the present time, to reach its 800,000 employees.

That lone employee magazine of 1903 has become a big family of publications of many kinds and purposes. These are produced, in most cases, by the Public Relations Departments. The magazines have been supplemented by newspapers, "external" magazines, tabloids and bulletins of various kinds. Here is a tabulation of our Bell publications, including those of Western Electric and the Bell Telephone Laboratories. We now have —

23 Employee Magazines, each circulated to all employees in its company.

4 Magazines for special readership groups: The *Bell Telephone Magazine*, which you are now reading; the *Bell System Technical Journal;* the *Bell Laboratories Record;* and the *Western*



First Bell Magazine: "Cumberland Telephone Journal's" initial issue was long on type, short on pictures. Personal items and pithy sayings got a good play

Electric Engineer—the last two being semi-technical in nature.

8 "External" Magazines, published for the larger business customers of these companies, especially the people in charge of, or who operate, their Private Branch Exchange switchboards.

23 Tabloid Newspapers (of which 18 are Western Electric plant papers). These are circulated to all employees of the company or area served.

44 Employee Bulletins. These generally perform the same functions as the tabloids mentioned above, but are less pretentious in size and appearance. They are letterhead-size, are usually printed in "offset," and carry some pictures. Many of these are regional; usually they cover a single state in a multi-state company.

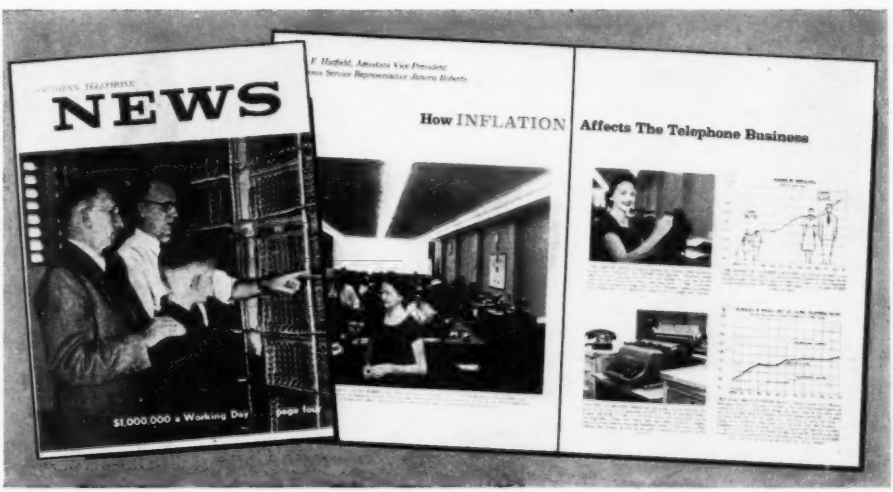
18 Management Bulletins. These are for primary distribution to supervisory forces, and are similar in format to the employee bulletins.

The above are the "main line" publications, issued with regularity and considerable frequency. In addition, there are many other bulletins, issued on a "now and then" basis and covering such specific subjects as Merchandising, Labor Relations, Retired Employees, Community Relations, News Clippings, and others.

RETURNING NOW to the magazines, why were they started? And are their objectives the same today as in the beginning?

The magazines, first of all, were started as a means of spreading information: to tell the employees the news of the business and the progress of the telephone art.

The second purpose was educational. If you look in the early bound volumes of the Bell magazines, you'll find quite a bit of space devoted to fairly technical articles. Presumably such pieces took the place of the circular letters and instruction practices of today. One wonders how much attention they got—unless the readers of that time were made of sterner stuff than their modern counterparts!



Direct descendant of pioneer paper is "Southern Telephone News". Contrast its colored cover and open, inviting layout with the earlier example, opposite

A third purpose was to build team spirit through recognition of jobs well done. When an employee saw his name or picture in the magazine, he was drawn more closely into the company "family circle." Recognition was—and still is—one of the most vital elements in the making of a successful employee publication.

There were other purposes, too, like promoting safety, efficiency, and the avoidance of waste; and building pride in the institution and confidence in its management.

But one of the most important uses for the medium was the enunciation of company policies. This function has come into special prominence in the past two or three years. More and more company publications around the country have come to recognize that they have a duty as well as an opportunity to set their employee readers straight on matters that are as vital to *their* well-being as to the company's.

This "bolder writing" or "speaking up" is all the more essential in an era when business—especially "big business"—is fair game for dissidents of many kinds.

Bell System editors, like their brothers in other businesses, have welcomed the new trend. As a matter of fact, the Bell magazines always have carried a good proportion of "meat and potatoes" articles along with the "salad and dessert" features. But they are printing more of them now, and doing it more incisively.

Though these articles are harder-hitting than they once were, you may find their brand of "speaking up" still a little less abrupt than that of some other companies. If so, it can be credited to our belief that one can be frank without being bitter, forceful without calling names. We have always gone on the premise that our employee publications exist to *unite* rather than *divide*.

THIS LEADS US to the question: *Where* do we print *what?* Here is the present trend in most Bell companies.

The *magazines*, with their superior facilities for layout and illustration, are the logical place for the longer articles. They are especially suitable for pieces without a time element—for it takes longer to produce a magazine, and news can get stale between the happening and the telling.

Although they are written primarily for telephone employees, most of the magazines have some outside circulation: to libraries, newspapers, other businesses, and some governmental officials. And of course they are sent to retired employees.

The *all-employee papers*—which group includes the tabloids and the employee bulletins—take less time to produce and hence are better for spot news. More like newspapers than magazines, they are well set up to run short items about the business and its employees, local news happenings and, in some cases, service anniversaries and organization changes. Often regional, they offer a detailed *local* coverage not available in the magazine without waste circulation.

The *management bulletins* afford a splendid way to get information to the supervisory forces quickly. Since they are addressed primarily to a group that is looking for information—in fact, anxious to get it as soon as possible—this is the medium most used for detailed, "brass tack" pieces about company policies. The management bulletin is looked upon by most supervisors as a valuable working tool.

Posted on this bulletin board is a cross-section of Bell System publications. In the top row are seven of the 23 general employee magazines. Next below are some typical employee bulletins and tabloid newspapers. The third row displays (left) technical and semi-technical magazines and (right) "external" or customer magazines. The bottom row contains management bulletins

A magazine editor and his assistants meet to plan the next issue

What of the quality of these Bell publications today? They are among the nation's best—and any impartial house magazine authority will confirm this opinion.

The Bell companies have picked able people to run their publications, and have given them the wherewithal to do a proper job. They have done and are doing it.

The magazines and papers today reflect the latest editorial, illustrative, and layout techniques. With characteristic Bell System autonomy, each company publishes whatever it wants, in any form it wants. The result is a group of magazines ranging from tiny Digest size (like *Indiana Telephone News*) to big "House and Garden" size (*Southern Telephone News*). But most of them are either letterhead size (such as *Southwestern Telephone News*) or slightly larger (like *Long Lines*).

Behind the inviting cover of any Bell magazine, you'll find a wide variety of articles about the business and its people. As in most national magazines today, photos form an important part of our Bell magazine contents. And to an increasing degree these are taken with natural light instead of the baleful flash. More and more the stories are told in terms of people and often in the lively "first person" or eyewitness technique.

All this does not mean that we think Bell publications are perfect. But within their sphere and under their limitations, they are truly good—and their editors are always striving to make them better.

The job of editing a house publication is not an easy one. The editor of one of America's greatest national magazines recently said this to our Bell System editors:

> "If my magazine had to operate under your limitations, it would go broke in a month . . . You are really competing with us for attention and should throw everything you have into it. You're competing with TV, too. Try to do something as often as you can for reader interest. Don't make the mistake of thinking you have a captive audience — you haven't!"

Our System editors have taken this advice to heart and they are "throwing everything they have into it." I think the results reflect the effort.

Some of the Bell editors have sat at the editorial desk for a number of years; others are fairly new at the game. But they all have one thing in common: a strong professional sense. Sit in at one of their system-wide conferences, and this will be the first thing to impress you. They are devoted

telephone men and women, but along with that they are dedicated professional editors – in the same sense that our System doctors and lawyers are professional.

Many of them are Journalism graduates; some have outside press experience; some have come from other telephone work. But they all have a love for the written word and a profound respect for its potentialities.

Whether his staff numbers several people or only one or two, the employee publication editor is a busy person. He must make up the "menu" for the coming issue, then see that the meal is prepared and served. Carrying out the figure, he must use the same care in making up the menu that a dietician does, for a badly balanced meal may mean literary indigestion. The editor must get enough "message" into each issue to make it pay its way, yet not overdo the thing. So he has to include an admixture of the lighter side of telephone life: a hobby story, a personality sketch, or a photo feature on a day in the life of an operator.

If the editor's day is one of pressures, it is also one of pleasures. His job is peculiarly self-rewarding; he likes his work or he wouldn't be doing it. He will say "amen" to Ellery Sedgwick's description of the editorial calling as "The Happy Profession."

Do we know whether our printed media are doing an effective job? In this field of telephone activity, as in most others, research is called upon to give the answer.

Bell publications use surveys in two ways: to determine the character of their audience and to measure their readership.

In the first instance, we have learned through such studies that the magazine

A Public Relations vice president and members of the Department discuss the company's employee publications and related uses of the printed word

Scaling pictures to fit page layouts is an essential part of employee magazine production

Visual control: "dummy" page on board shows that it has gone out to the photo-engraver

Colored pins in company map mark the many localities covered by magazine during the year

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audience in the operating companies is largely of high school level and is strongly feminine – not surprising since women comprise about 60% of all telephone employees. Most of them are between the ages of 19 and 25, which gives us a youthful audience.

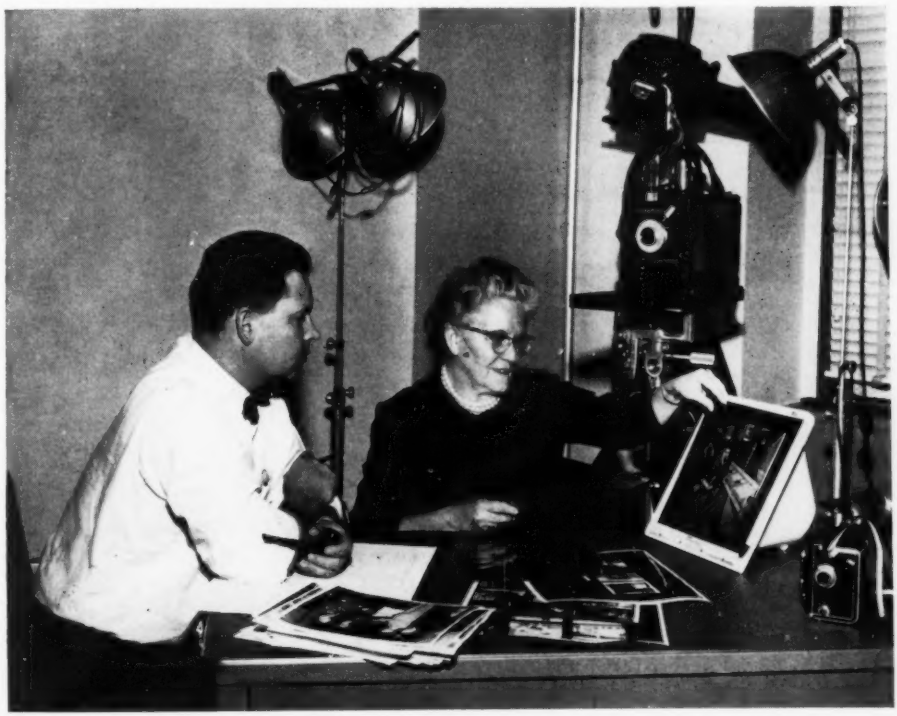
Knowing the character of his audience and its informational interests can be extremely helpful to the editor in putting together a balanced magazine that will interest the greatest number of readers.

In the second instance, through readership surveys of various kinds the editor can measure the relative effectiveness of his publications. Through such studies, for example, we have found that, while nine out of 10 employees say they like the magazine, an editor should be pretty well satisfied when 50 to 60 per cent read an article.

The most reliable readership surveys are the so-called "impact studies." Here, readers have to prove their readership to interviewers by "playing back" from memory the salient points of the articles they claim to have read.

During the last 25 years, Bell System companies have made or shared in about 45 surveys of the types mentioned. The results have been most helpful in charting the course of their publications.

But even with the best research in the world, just having the facts isn't enough. It's the kind of judgment the editor uses in interpreting them and in putting the findings into practice that determines their ultimate effectiveness.



Today's pictorial journalism enhances the importance of good photographs. Here an Associate Editor and a Photo Editor select a color transparency

A Bell System conference of editors finds in these intent faces a reflection of their devotion to the potentialities of the printed word

For over half a century, these employee magazines and papers and bulletins have helped the Bell System give an ever-improving service. Month after month down through the years, these regular and always-welcome visitors have brought news and information, education and inspiration, to the ever-growing, ever-changing community of telephone people.

As time has passed, other valuable methods and media have come into begin and have joined the printed word in broadening the horizons of the employees of this great industry. Still other ways will be found in the years ahead. But we freely predict that nothing will ever completely take the place of the publications, and that in fifty or a hundred years they will still be helping telephone men and women to do a better and more effective job.

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TELEPHONE TAXES

(From the January 1958 Share Owners' Quarterly)

TAXES ARE the cost of government—of schools, roads, and police—of Army, Navy, and Air Force—of atomic weapons, aircraft, and missiles.

There are compelling reasons, too, why the tax load today is so heavy. The biggest reason, as we all know, is the enormous cost of defense. The future is at stake. Everyone must share in paying the price.

So, inevitably, taxes are a large part of the cost of telephone service. Perhaps some people think of taxes on the Bell System only as money paid out by the business. But every tax dollar the telephone company pays out, it must first take in—from telephone users. There is no other way. Taxes are necessarily a part of the cost of service.

And as we said, a big part. In 1957, Federal, state, and local taxes on the Bell System will total about $1,300,000,000—*not* including the 10 per cent Federal excise tax paid by customers on both local and long distance service.

This $1.3 billion tax is paid by more than 34 million Bell System customers. It is enough to build 1,300 schools at a million dollars apiece—or alternatively, more than 160 long-range bombers.

It is equal to 20 cents out of every dollar we receive for service rendered.

It is equal to *all* the dollars we took in from January 1, 1957, until the middle of March.

It is equal to nearly $20 per share of A. T. & T. stock—more than twice as much as the $9 annual dividend paid to 1,600,000 share owners.

It is equal to more than $2 a month for every Bell telephone.

The biggest chunk in the total is the Federal corporate income tax, now levied at the rate of 52 per cent. This comes to more than $760 million.

But there are dozens of other taxes too. Local taxes on telephone property. Federal and state social security taxes. Unemployment taxes. State and municipal franchise taxes, taxes on receipts and earnings, and taxes on capital stock. And many more. Grand total —$1.3 billion.

FEDERAL EXCISE TAXES

The facts above indicate that the telephone is carrying its share of the country's tax load. It is pulling its weight in the boat. Its full weight, you may feel.

Today, however, telephone service also carries an extra tax burden or "supercharge" which is laid on top of all the others.

This is the Federal excise tax of 10 per cent already mentioned. In 1957 this increased the total tax on Bell System service by an *additional* $515 million.

We strongly believe this tax is discriminatory. We have so said in the past to the taxing authorities in Washington, and will again whenever suitable opportunities arise.

Telephone service is an essential. Jobs depend on it. Lives depend on it. Trade and commerce depend on it.

But it is subject to excise tax at the same rate as furs, perfume, and jewelry. In fact, only a very few things, such as liquor, tobacco, club dues and cabarets, are taxed at a higher rate.

Telephones, electricity and gas are all regarded as household necessities. There is no Federal tax on electricity or gas. Nor is there any on local transportation. But use of the telephone is taxed 10 per cent. One necessity carries a load that the others do not.

At the very least, and in particular, we think the excise tax on *local* phone service should be ended as soon as circumstances will permit. This began in 1941 as an emergency measure. To regard it as proper for the long run seems to us unthinkable.

We fully recognize the great problems involved in obtaining enough tax revenue to meet all the country's needs. But there is always the need, also—and lawmakers are always trying—to be as fair as possible in spreading the burden. We urge, therefore, that in doing whatever is necessary to solve immediate problems, they will also consider how to avoid *perpetuating* a high-rate excise tax on essential service. For even without this, telephone users are paying a pretty big share of the nation's tax bill.

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Forty-five years of service help to put in perspective the advances which have taken place in many aspects of this wide-flung enterprise

WE CAN THANK OUR LUCKY STARS

LEMUEL S. CROSBY

Executive Assistant, retired, PERSONNEL DEPARTMENT, LONG LINES, A. T. & T. CO.

Following his recent retirement after some 45 years of service, Mr. Crosby prepared, at the suggestion of some of his associates, a manuscript covering many phases of his business career. Portions of this material are here presented because they touch on many key developments in Bell System personnel practice and suggest as well the color of earlier days in telephone work. EDITOR.

WE WHO NOW WEAR EMBLEMS that symbolize long service in the Bell System have had careers which fall within an era marked by some world-shaking events and startling changes. Concurrent with these have also been the growth and development of our modern communication systems.

I speak as both an individual and a member of a group of nine-star employees*—the forty-five year service men and women. Practically all of us started as teen-agers and at a time when the telephone had been in existence only about thirty-five years. Had there been service emblems then, even those with the longest Bell System service could have worn only seven of these symbolic stars. Statistically speaking, our group was more native to country, town, or small city than to the metropolitan environment. We were born in the Gay Nineties (and often wonder why they were so named). We spent the early years of this century in old-fashioned school houses or dimly lighted study halls pursuing learning the hard way, with no thought of progressive systems yet to come.

I well remember when I saw for the first time a five-story building, an elevator, an automobile, and when Father and Mother took me to a "real city." I also remember my first telephone. It hung on the wall in the back part of a store, a queer kind of cabinet-like object with a wooden back and a box at the bottom somewhat like a little chest in my Mother's pantry. There was a crank and something that stuck out, like one of the vases on our mantle at home except that it extended sideways. I saw a

*In most Bell System companies, service emblems have one star for every five years of service.

man crank the crank and talk into the "vase." At once I felt proud that I was seeing the "telephone" I had heard about and did not have to ask anyone what it was.

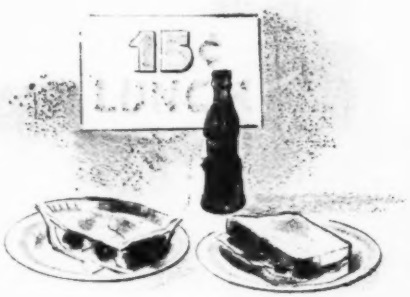
When I started to work for the Southern Bell Telephone and Telegraph Company,

on July 1, 1912, it was before the advent of many things that chart our way of life today. It was, for example, before income taxes, parcel post, women in high public office, radio broadcasting, electric ice boxes, talking movies, blood transfusions, antibiotics, television, motels, and parking meters. But if you had a Cadillac that year, you could have a new device called a self-starter.

Bell System telephones had reached a total of five million; our assets had yet to grow to one billion dollars, but the financial world was amazed that the number of A. T. & T. Co. share holders had reached 50,000. Our Benefit Plan, with its disability, pension, and death benefit provisions, was yet to come. In communications, the period was before the transcontinental or overseas telephone service, the vacuum tube, and a host of technological developments we have become accustomed to. These, in the words of a popular song of the era, were down a "long, long trail a'winding into the land of our dreams."

My starting pay of $50.00 per month was just about normal for beginning engineers. This was for a six-day week with few holidays and no overtime or premium payments. A personal budget was a finger-counting affair. Working on the outskirts of Atlanta, for example, you could usually find a corner drugstore or soda fountain where a fifteen cent lunch could be procured. This included a generous ham sandwich (hand sliced, not machine shaved), five cents; a piece of apple pie (full sixth), five cents; and a glass of coke (with cracked ice and a slice of lemon or lime), five cents.

For my first day of field work I was assigned to a cable construction crew, and had been told to join it at a combination garage and storeroom. (The name "garage" was a bit futuristic, as our construction



gang used horse-drawn wagons.) I arrived fifteen minutes before the starting time I had been told, but no one from the crew was there. "Bo, that's the starting time on the job, not when you set out to get there," it was explained. (Portal to portal was a

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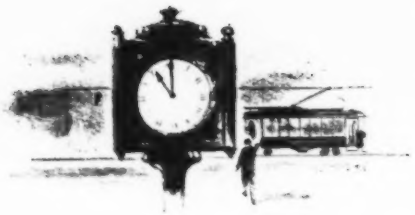


concept yet to be invented.) I was told the streetcar to take in the general direction of work and I reported at 11 a.m. But the foreman understood and only chuckled at my humiliation. I now know this was a slip in "communication."

[During his first year a number of assignments in the Plant Department provide material for the Crosby manuscript: the kindness and instruction of a helper whose subsequent death influenced his later interest in safety work . . . the migratory workers called "floaters," who turned up with some lineman's equipment, were hired, and in time vanished . . . the practical wisdom of a foreman . . . and "Lem's" prize boner during an installation assignment while in training. EDITOR.]

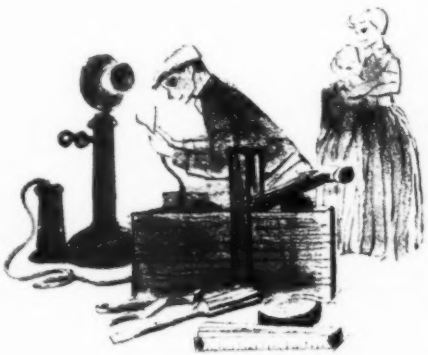
When I rang the doorbell of an unnumbered house in a new section of town I was urged to come in by a lady whose grown daughter lost no time in showing me where they wanted the new telephone. I installed the instrument, ice water was served on that hot summer day, and both ladies seemed as gleeful as children on Christmas morning.

Several days later the Commercial Department reported that a man who should have had that telephone installed in his house had complained. A rush job was done with apologies—and I was instructed, as a matter of discipline, to retrieve the telephone from the nice ladies. I wondered what to do in case of an emotional outburst, but my preparation of some opening lines was labor lost. The ladies, as downcast as I was, did most of the talking. In attempting to "bring up father," they had asked, urged, and begged for a telephone. When I appeared at their door, they happily thought that father's sales resistance had softened.

This episode is related to other cases of "life's darkest moment". In the dance-mad days before World War I, a new girl just met could be so charming, beautiful, and vivacious, and dance the new fox-trot just divinely. But when at the punch bowl one whispered about putting down her telephone number in a dance program, too often she flushed, choked, and looked away. Then she would mumble something about writing a note—because at her house, alas there was as yet no telephone. A far cry from today's teen-age listing . . .

ON AUGUST 1, 1913, I shifted to the Long Lines Department payroll. Although my assignment was rooted in craft matters for another year, I had a limited opportunity to coach other young men, and that was a significant experience in view of my later work.

In general, my regular Plant and Engineering activities continued, and one of the thrills of my young career was to be



involved in the opening of the first transcontinental telephone line. For 72 hours, with a minimum of cat naps, we worked around the clock on improvised equipment to be used in picking up Theodore N. Vail, president of A. T. & T., and his distinguished guests, who were at Jekyl Island, Ga. Longer-service employees will remember this opening and the many demonstrations at various cities which followed. Telephone receivers were wired to each table place so that the guests could listen in on coast-to-coast programs. The development of an effective loud speaker in 1921 outmoded such a practice.

My first visit to Long Lines headquarters in New York, where I was to spend so many years, came in 1916, when I assisted in preparing installation specifications for long distance equipment. The following year I went there again, before the war but nonetheless to discuss a proposal for accepting a commission in the Navy in the communications field. I was given a brief interview by various executives—including the General Plant Superintendent, later the head of Long Lines, F. A. Stevenson—all of whom made the now familiar point that the company intended to do its utmost in meeting the need of the military services for communication specialists.

When war did come, I spent some months at Key West, Florida, a short training period at the Naval Academy, and another aboard the newly launched U.S.S. Mississippi, and served aboard the U.S.S. Missouri (forerunner of the "Big Mo") on the Admiral's staff.

On returning to the Long Lines Division Plant office in Atlanta in 1919, I encountered some changes. Previously, it had been run by men, except for three stenographers, restricted to a single room. Now, newly graduated school girls were there in force and my own desk was so occupied. I wondered when this might get back to normal as I had known normal to be—but it hasn't yet, and probably it never will.

In the late Spring of 1919 the General Departments of the A. T. & T. Co. held the original transmission school for operating people. Twenty-two Long Liners—including four of us from Atlanta—occupied two months in intensive technical study. This was the launching of an enlarged technology for our business—and a turning point for me, for it was a deciding factor in later channeling me into personnel work. Back in Atlanta I was given three new graduates*

from engineering school for "orientation" (although the word was not then used by us) and guidance in some developmental field assignments. And I assisted with some college recruiting.

In November, 1920, I was transferred to Plant headquarters in New York, my title being designated Supervisor of Instruction about a year later. The work was to set up training courses for Long Lines Plant forces, with suitable texts and instructions

*One was the present A. T. & T. Vice President in charge of Long Lines, who remembers his "orientation" with gratification. EDITOR.

in methods of teaching. There were two principal goals: to better acquaint the craft forces with newer technical features; and to give employees a broader perspective of Long Lines, its organization and its place in the Bell System.

Within the year, the work also involved coördination for the better selection and development of young college recruits. The second year following, we introduced a recruiting program for high school graduates who had aptitudes for learning craft work.

Various "crash" programs were added, too. One was to escort groups of administrative employees at headquarters—who had not yet had opportunity to visit a central office—through operating rooms, Plant terminal rooms, and other installations at 24 Walker Street (a building later to become part of the present Long Lines headquarters.) These guided tours included a talk, and the distribution of notes previewing and high-spotting the trip. Ultimately demand grew—not only from employees but from those in many walks of life who had a yen to learn more about the technical aspects of the telephone business—and the whole project had to be reorganized on a separate basis in the Long Lines public relations organization.

There was not much conflict of ideas on the need to offer training courses to men who held craft titles, nor on the desirability of appreciation and development courses for potential leaders. But there was a lack of consensus as to the "how," and efforts were made to seek counsel and explore what those in other Bell System units were undertaking. There were advocates of the question and answer method, group discussion, reading, professional teachers, and the Chinese theory that one picture is worth a thousand words (and the sequel that one movie is worth a thousand stills.)

ALTHOUGH THE DECISION was made to try each method where it seemed best in a particular situation, a suitable textbook seemed a "must." By the fall of 1921 we in Long Lines had prepared a tentative set of fourteen lesson assignments, under the title "Elements of Electricity Applied to Telephone and Telegraph Work," and had conducted a few pilot classes. While other Bell System organizations were confronted by instruction in matters of local telephone dial systems then making headway, we emphasized such electronic aspects as vacuum tubes and the training necessary for this understanding.

At about this time the Department of Operation and Engineering of the A. T. & T. Co. undertook the preparation of an elementary text for use among the Plant forces throughout the Bell System. A committee of people from the Bell System Associated

Companies, as well as myself, joined with them. In view of this material becoming available, the Long Lines text was revised, and directed more to long distance communications practices. It was enlarged, however, and "Elements" became "Principles." This was the beginning of a Plant training manual that grew into many editions and in 1928 became a printed textbook. The O. and E. Department referred it to the Associated Companies for use when it too might be applicable in their training, and arrangements were made for it to be reprinted and stocked by Western Electric.

Over the years several hundred thousand copies have been distributed and, since the early edition, it has been re-edited several times. In addition to its use within the Bell System, it has also been made available to technical schools, the military forces, and other institutions and industries concerned with electronic technology. Thus, the volume has become something of a classic in its field.

EARLY IN 1924 some 1600 Long Lines craftsmen had enrolled in our "Principles" course and many of these were interested in more advanced study. By the latter part of the year a program had been set up for the employment and training of qualified high school graduates. Such orientation had become an established procedure.

Other activities were assigned to our unit—notably, an intensive campaign to reduce accidents and to standardize and promote the best safety practices. This involved the analysis of all cases of injury, the issuance of bulletins, the preparation of a code by an employee committee, its distribution to every employee, and establishing competition for a trophy. Allied to this was the introduction of first-aid training classes in the Plant Department. This was not the beginning of intensive efforts to effect safe working practices in Bell System companies nor was it a sustained campaign. However, it was a milestone in early efforts to make every employee conscious of the importance of performing all work safely.

At about this time still another means for effective development and leadership was established: supervisory training that used the conference method.

DURING THAT SAME YEAR my title was changed to General Employment Supervisor and I was appointed to the Long Lines Benefit Committee, which administers the Benefit Plan. Little did I dream that I would attend the weekly meetings of this committee more than 30 years, serving more than 28 of these years as chairman. To me, no work was ever more enriched with human interest.

To be observed over these years was the living reality of social progress in health promotion and the more effective treatment and prevention of physical injuries and illnesses. Many of the last, which were prevalent in the beginning, later became rare or practically extinct. The work of both the Benefit Committee and its closely affiliated medical staff was a contribution to such social progress. (Once the Benefit Plan had been established in 1913, incidentally, a Medical Director was appointed by the A. T. & T. Co., and ultimately medical counselors and nurses were introduced in many Bell System offices large enough to warrant such arrangements.)

I recall that earlier, hardly a Benefit Committee meeting passed without pro-

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longed discussion of cases labelled "tubercular" or of infectious diseases that frequently did not respond to the best medical treatment of the period. These subjects became quite unusual topics with the introduction of the new "miracle" drugs and other achievements in the medical field.

The most inspiring incidents in this long experience on the Benefit Committee came from observing the cases of those individuals whose will to live and serve triumphed over medical opinion that, in layman's language, gave little or no hope. I have in mind the occasional man or woman who, despite a serious health handicap or physical impairment, carried on as a tower of strength—especially to the morale within the organization. In contrast, of course, were those frustrating situations to be found in every large group—the "repeaters," the accident prone, and extreme psychosomatic cases.

Reverting to the mid-twenties, a turning point for more effective employment and early training of construction forces came about in the mid '20s, when the General Plant Manager urged that, henceforth, all construction programs be planned and scheduled as far ahead as possible, to provide more steady employment for selected workers. Without this, we would lose good men because of the fluctuating build-up of forces, lay-offs, and later a frantic re-employment.

In September, 1927, I became General Personnel Supervisor, with responsibility for the training which was on an interdepartmental scale, the preparation of texts, and the coördination of college recruiting formerly done in each department. This was a most stimulating challenge and it held great appeal.

With enlarged responsibility came participation in numerous meetings. Looking back at literally thousands of discussions one is aware of views propounded, information acquired, ideas crystallized, judgments posed by busy leaders and professional men. These observations of pooled opinions, broadened perspectives, and conflicts with honest but divergent conclusions are no small part of the deeper meaning of "men working"—with facets of "men learning," "men thinking," and "men growing."

Another of the early requirements of this new job was to get across the story of more comprehensive thrift programs, including a newly approved payroll allotment plan for life insurance. This plan followed generally similar ones introduced by some of

the Associated Companies and coördinated at 195 Broadway by the General Departments of the A. T. & T. Co. This was the third of a series of payroll allotment plans established by the Bell System directed toward thrift among employees. The earliest, dating from 1915, was subscription to A. T. & T. Co. shares by installment. The second provided for deposits in designated savings accounts.

Years of observation have shown the effectiveness of these plans. One is amazed at the many instances when, at retirement or death, employee assets have been identified with these thrift facilities. There was nothing of the sort when I started to work, and when I consider the present list of such deduction or allocation arrangements —for thrift, for hospital plans, for community contributions, for taxes, etc.—it is impressive indeed.

As the '20s marched on, greater employment brought training on a more extensive scale and the introduction of another Long Lines textbook that was the forerunner of the present Long Lines volume, "Our Company And How It Operates."

Various Bell System inter-company committees met to study desirable changes in our Benefit Plan, now well into its second decade of life, and I took part in their deliberations on this and allied personnel matters.

On October 23, 1929, about fifty Bell System people assembled in Washington, D. C., for an eight-day personnel conference. During the preceding ten years, personnel staff functions had been given a more formal status, and by this time such conferences were well established features. This one, however, in a way marked the end of an era—for the following day saw the big crash in Wall Street.

In Long Lines, the early shock was not as great as might have been expected. New emergencies caused customers to turn to long distance. But ultimately we too felt the pressure, and personnel problems took forms we had not known before. To many of us it is an all too familiar story, but I would like to refer to one important policy decision within the Bell System. Although a reduction in the volume of work necessitated a corresponding reduction in the total working hours, it was nonetheless decided that the basic rates of pay were not to be lowered. This made it possible to retain most of the more experienced working forces with little or no loss in their real earnings, because of the falling price levels of most commodities in this period.

As the impact of the depression became more evident, campaigns for social relief got under way. (In a sense, these procedures continue today in our established drives within industry for community fund appeals.) These were the years of a host of legislative measures affecting the economy and of transforming changes on the political front. "Pump priming," new laws, new governmental agencies, new social attitudes marked these years of high unemployment.

An epoch-making law of 1935 was the original Social Security Act, providing old-age annuities, unemployment insurance, and some direct relief measures. That too

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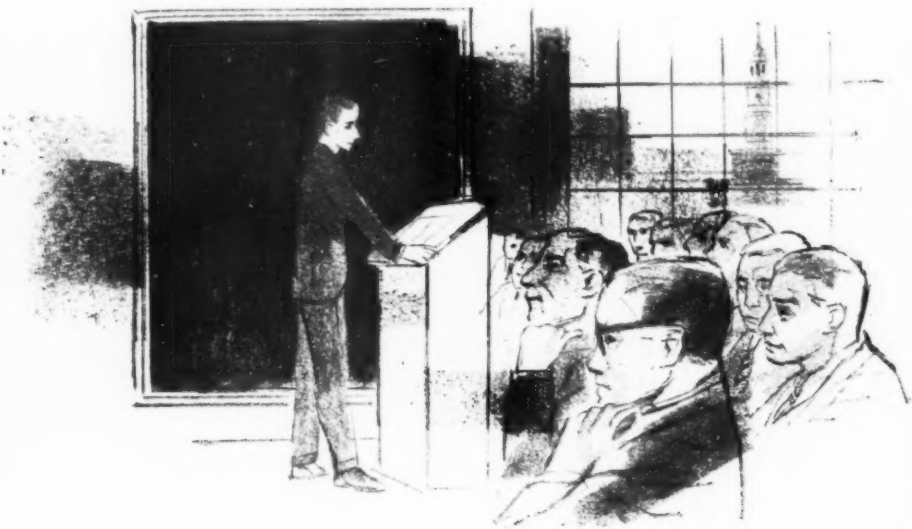
was the year when the legal status of collective bargaining and the position of labor unions were enhanced. All these governmental regulations made the depression years busy ones for personnel and staff people. Although most of the practices set up within the business met the objectives of many of the important new laws of the period, some laws—such as Social Security, the Fair Labor Standards Act on wages and hours, the Federal Communications Act—required procedural adaptations.

We had scarcely seen indications of economic recovery in 1941 when still another abnormal situation confronted us: "all-out war effort" became the slogan. About 2,500 Long Lines men and several hundred women were to answer the call of the Armed Forces. In addition, some highly trained technical men were requested, and referred to the service for civilian investigative work related to the war. We in Personnel were also called upon to administer a plan under which highly qualified men called into the Army were furnished certified resumés that would facilitate their being channeled into the branch of service which would benefit by their experience in communications work. Again, to retain a minimum of those able to provide essential long distance service required the processing of some deferment applications.

With the war over in 1945, those on military leave had to be reinstated in an orderly plan. (Bell System practice, incidentally, was more liberal than the requirements of the Selective Service and Training Act.) Finally, certain of our people with special qualifications remained in temporary Government service in a civilian capacity to handle various defense projects. Many others within the Department and the Bell System also shifted assignments to work being done under contract for the Government by the Western Electric Company. The building of the DEW Line in Alaska is a recent case in point.

After a fourteen year stretch of less than normal activity, employment and training were reactivated for the expanding postwar world. And, as is familiar, a unit had



to be set up to cope with constantly increasing collective bargaining activity and the administration of wages and working practices under governmental controls.

In 1955 I took on further duties related to supervisory training, development, and placement activity under the title of Executive Assistant. My own interest in this endeavor had, of course, extended over more than forty years, and I sensed with great satisfaction the deeper understanding of its importance by men at all levels in our Long Lines organization. Following attendance at one of the four-week Bell System Executive Conferences, held at Asbury Park, N. J., I participated for over two years in the direction of a series of shorter development conferences held at Princeton, N. J., for our Division and District management people, with the selection and scheduling of people for other Bell System developmental programs.

Over these years, we in the Bell System have accomplished much in training for technical "know how" and have made great strides in developing leaders. But I do not feel that we have yet passed the pioneering stage in matching skills, interests, tastes, temperaments, and compatability of personalities with the job. This is particularly true of individuals handicapped by hidden but remediable shortcomings, and of such problems as teaming aggressive characters with sensitive souls.

BUT SUDDENLY THERE CAME the retirement party, with its compound of fun, amiable raillery, and kindness. In the traditional way there were gifts, now treasured, and the prized presence or message of many a friend who had shared some part of my career. They came from many parts of the Bell System.

First impressions are lasting. Though I cannot establish it as more than coincidental, I believe that the impressions I gained in my first few assignments had much to do with my many years devoted to the problems of selection, training, and development of people. I think of the slip in

communication leading to my reporting to my first job hours late. There was my pride in craftsmanship in installing a telephone—but in the wrong house. Again, there was the shock that came from the fatal accident to an associate on my first job. Did that event really lead to the day when I directed the first Long Lines Plant safety campaign with its new safety code and the later competitive contests for a trophy presented by the head of Long Lines?

In retrospect, one's observations and experiences over a 45-year career encompass a great deal more than can or will ever be told. To be observed in our economic and social order are many a swinging pendulum—along with startling changes. Race suicide, for example, was much written about in the early part of the century and today we hear alarms about inadequate schools to take care of our bumper crop of babies. Prohibition came—and was repealed. A centralization of population was followed by a scattering to suburbia. National vocational guidance steered youth toward and then away from engineering and physical science, and now we again have the reverse movement. My observation is that in the Bell System our growth and progress have been in general consistently forward.

In the over-all I believe that the amazing changes of the past 45 years have contributed to a better way of life for the future—the one big question mark relating to the increasingly destructive machines of war in the missile age. This distress signal, however, reminds one of others over the years—and I am optimistic as to the ultimate outcome.

There is a current expression to the effect that it is easier to smash an atom than to alter an attitude. Many of my convictions as to the best answers to controversial questions in the area of personnel relations are unwavering from those held in early life. Yet others reflect almost complete reversals.

I have greatly admired various Bell System contributions to these answers. To mention a few: our standards in selecting young men for leadership, technology, or other specialized work; our studies of the effect of the workers' environment on production—the oft cited Western Electric Company investigation at Hawthorne; the affirmative findings and conclusions of Walter S. Gifford, then President of the A. T. & T. Co., in his *Harper's Magazine* article of May, 1928—"Does Business Want Scholars?"; the conference developmental approaches for strengthening leadership qualities in management men.

It is often alleged that there is a "reluctance to change with advancing age." Mine is a contrary philosophy, which holds that all things divide into two parts. First come those things, sometimes called our heritage, that were here when we were born and which we are prone to take for granted, like the air we breathe. (How often have most of us of mature years deplored the complacent attitudes of youth about such things.) Second, there are those other things we have in later life acquired, cultivated, achieved, or seen and understood with amazement through conscious effort. These are the things in which great changes have been wrought while "we were there." In these we have a continuing interest and appreciation, and they take their places among our many enduring satisfactions—for which we thank our lucky stars.

Who's Who & What's What

(Continued from page 3)

distribution engineer, and in 1935 requirements engineer, and two years later he was appointed personnel assistant to the general manager of the telephone sales division. In 1942 he became the Company's personnel director and he was in 1948 and 1949 Works Manager of the Allentown and Tonawanda Plants and 42nd Street Shops and Manager of the Point Breeze Works.

In 1949, Mr. Goetze became personnel vice president of the Chesapeake and Potomac Telephone Company, and in 1950 operating vice president of the Ohio Bell Telephone Company and a member of its Board of Directors.

Since returning to Western Electric in 1952, Mr. Goetze has been successively vice president and works manager of the Kearny Works; vice president, manufacturing – Eastern Area; vice president, finance; vice president, manufacturing; and president of the Company.

STARTING WITH The Pacific Telephone and Telegraph Company in San Francisco in 1924, GEORGE M. DEAN had been moved to Seattle by 1926, and to Seattle and the Washington-Idaho Area he remained true for the next 30 years in positions leading upward from commercial engineer to Area vice president and general manager –with time out for nearly six years of Army service. In April, 1956, he moved Eastward to A. T. & T. in New York as an assistant vice president in the Department of Operation and Engineering. The call of the Pacific Coast lured him, however, and since November of last year, he has been vice president and general manager of the Pacific Company's Northern California Area. The "guest editorial" published in this issue he wrote while still a member of the A. T. & T. staff.

R. Irwin Johannesen

THE PUBLICATION which R. IRWIN JOHANNESEN holds, in the adjoining photograph, is not a "prop," but one of the many booklets and employee magazines in which, as publications manager, he takes a paternal – or at least an avuncular – interest. He started his telephone career in 1921 as a student accountant and later was a Commercial representative with the New York Telephone Company, but within three years he had moved to the Advertising and General Information Department. He was named copy supervisor in 1929, and was appointed editor of *The Telephone Review* in 1936—a post he held for the next decade. In 1946, he moved to A. T. & T.'s Public Relations Department as information manager, his present title being Publications Manager.

THERE IS scarcely any need for "biographical data" about LEMUEL S. CROSBY, since

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Lemuel S. Crosby

the article he contributes to this issue recounts his 45-year telephone career *in extenso*. Suffice it to report that he was born in Mohawk, Tennessee, took employment with the Southern Bell Telephone and Telegraph Company in 1912 at Atlanta, transferred to Long Lines a year later, spent most of the remaining years in personnel work, and retired last December after some 45 years of service.

CONSTRUCTION EXPENDITURES by the Bell Companies in 1957 totaled some $2.5 billion. To help finance these expenditures, about $1,150,000,000 of new capital was raised by the Bell System in 1957, most of it through the sale of debt issues. In addition, more than $500 million had been obtained in the fall of 1956 through the offering of A. T. & T. stock to share owners.

Growth and construction are expected to be still very large in 1958 even though they may be somewhat less than in 1957, and consequently new capital requirements will again be substantial. Plans for raising the capital needed to provide for the 1958 program include the new $718 million issue of A. T. & T. convertibles and their subsequent conversion. The fact that most of the capital raised by the Bell System during 1957 was through the sale of debt securities caused a gradual rise in the System's debt ratio, from 33⅓% at December 31, 1956, to about 36% at December 31, 1957. Assuming issuance of $718 million of new convertibles, the debt ratio would be pushed up temporarily to around 38% or 39%. However, full conversion of the new issue (ignoring any intervening financing) would bring the debt ratio down again close to the one-third level.

Bell System management feels that its capital, in the long run, should be two-thirds in the form of equity and one-third in the form of debt. Furthermore, experience has shown that not more than 40% should be debt capital at a particular time. It will be seen that the new financing is in line with these objectives.

HEADQUARTERS SUMMARY

September 15 to Dec. 15, 1957

THE PLANT EXTENSION SECTION of the O. & E. Department has completed the conversion from manual to machine summarization of the Bell System construction program summary. This summary is a compilation of the construction programs sent in quarterly by the Associated Companies. Studies were undertaken late in 1956 to determine the feasibility of various processes in connection with mechanizing the summary, and the project got under way about February 1, 1957. Between February 1 and mid-July more than two man-years of effort went into the project. The October 1957 summary was completed by machine by the Service Bureau Corporation, with gratifying results. This resulted in reducing the five- to six-week preparation interval to approximately 10 days. Further reductions in time and expense may be possible as more of the Companies are able to send a deck of IBM cards with their program view forms.

AN IMPROVED type of PIC (Polyethylene Insulated Conductor) cable will become available with the opening of the new Omaha cable plant of Western Electric in the second quarter of 1958. This cable will have a new uniform color code and will come in "even" numbers of pairs; that is, 25, 50, 100, 200, etc. The traditional extra pairs that have been included in past cables, as a guarantee for manufacturing defects, will no longer be there as Western guarantees PIC cable to be free of shorts, crosses, grounds and opens. The cables will be made up in 25-pair groups, each pair of which will be identified with a distinctive color code. Also, each 25-pair group will have a distinctively colored binder to aid further in locating a particular pair. With identification of pairs in the new cables thus greatly simplified, splicing and installation time will consequently be reduced. The new color code will be used also for other wire facilities such as B Urban, B Rural, inside wiring cables, etc. It is simple, uniform, and permits any telephone craftsman to readily identify a specific pair and make connections to it.

RESULTS of trials of a new tool, known as the Shure-Set R-260, indicate that the time now being spent drilling holes for anchors can be reduced by about 60-75%. The time is saved by driving steel fasteners directly into the hard materials by use of this new tool and a hammer. In addition to being used as a driver, the tool can also be used as a drill-holder and, therefore, would replace the present masonry drill-holders. The drill-holder feature is needed for such surfaces as glazed brick, to avoid cracking the whole surface.

ON DECEMBER 6 a telephone call was made from Northwest Orient Airlines Flight 414, en route from Minneapolis to Chicago, to a telephone at A. T. & T. headquarters in New York. This marked the first use from a commercial airliner of the public air-ground telephone service now available on a trial basis in the Chicago-Detroit areas. At the time of the call, the Stratocruiser with 70 passengers aboard was about 150 miles northwest of Chicago at 13,000 feet. Following this initial call, a passenger completed a call to American Air Lines at Chicago to request that a flight be held for his arrival. On the return trip to Minneapolis, the flight captain announced availability of the service and a passenger made a call to an Illinois point.

A NEW multi-pushbutton key assembly, intended to supersede the present turret key-box and telephone set which now occupy a prominent place on many secretaries' desks, will be placed on trial in the New York Company starting in January. This rectangular assembly houses under one cover the usual station components plus plug-in units of fully convertible and illuminated 6-button key strips. The console has been designed not only for attractiveness but also for ease of maintenance and installation. The bottom of the 18-button version, with dial unit and handset, is 8 inches by 10 inches; the highest point of the consolette is only 4 inches above the desk top which makes it suitable for desk drawer installation if desired. Combinations having 12, 18, 24, 30 or more buttons will ultimately be available, with or without a modular speakerphone or dial unit.

THE 1959 Chicago alphabetical directory will be re-set to show 2-letter central office name abbreviations with a 3-column page format. This will be the second System directory to appear with a five-column page format; Detroit will be the first, with sched-

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uled conversion in 1958. A total of 160 central office names are involved, including 12 manual central offices. Explanation of the abbreviations will appear in a block on each 2-page "spread" for the 1959 issue. Two-letter abbreviations will also be introduced in the Chicago Yellow Pages (a separate classified directory). This is being done on a progressive basis, i.e., for new and changed listings, beginning with the December 1957 issue. Conversion will be completed by the December 1959 issue. The classified will continue to be published in a 4-column page format.

ONE OF the most familiar "memories" incorporated into "giant-brain" calculating and data-processing machines consists of a tiny grid of wires resembling window screen, with a magnetic "doughnut" or core around each intersection. Bell Laboratories has now developed a new memory device that has no cores. It consists merely of woven wires — copper wires in one direction and magnetic wires in the other—and therefore should be simpler and more economical to fabricate. It is called "Twistor" because the magnetic wires are given an actual or effective twist before assembly. This allows magnetic energy to be stored at the separate intersections as a result of pulses of current through vertical and horizontal coördinate wires. Because of the need for memories with large capacity in a small physical size, the Twistor should find many applications, especially since the auxiliary circuits for this device can readily be transistorized.

BELL LABORATORIES outside plant development people have designed a pneumatic pressing tool and a special metal-and-plastic sleeve for splicing cable conductors. The splicer uses the same tank of compressed nitrogen available for pressure-testing cables and joints. He connects the pneumatic tool to the tank and carries the tool to the splice. Next, he groups together the ends of two or three conductors without removing their insulation, and slips the special sleeve over them. He then places the sleeve and conductor-ends between the toothed jaws of the pressing tool and operates a trigger. Pressure is high enough to break through the insulation of the conductors and form a stable, low-resistance joint. The plastic cover of the metal sleeve remains as the permanent insulation.

LOW-POWER OPERATION is one of the transistor's chief advantages. Bell Laboratories has therefore investigated a number of sources of small amounts of power. The Bell solar battery, which was used in rural-carrier trials in Georgia, is one. Another is a highly efficient wind generator of novel design. Wind vanes are grouped in cylindrical fashion so that the cylinder turns regardless of wind direction, and any wind velocity above about eight miles per hour produces usable power for charging storage batteries. Another interesting arrangement under test at the Laboratories is a thermoelectric generator installed in a hollow metal pole. The lower part of the pole contains a tank of "bottled gas," which is used as fuel for a small burner. The burner is surrounded by a fabric-like mat of thermocouples, from which the electrical power is drawn. This power could be used directly in telephone equipment installed on the pole. It could also charge a battery installed on the pole to supplement the generator when currents stronger than talking currents are needed. It is thought that with most transistorized circuits, the tank of bottled gas would have to be refilled only about once per year.

POLYETHYLENE is today probably the most widely used industrial plastic, but it could not be readily bonded to metals. The chemical research department at Bell Laboratories, has developed a new process that results in very strong and durable bonds. With the chemical substance polybutadiene as an intermediate layer, and with application of pressure and heat, polyethylene is bonded to brass or brass-plated metals. The process can also be used to bond polyethylene to natural and some synthetic rubbers. Possible telephone applications are bonding insulation to drop wires, bonding polyethelene to brass in submarine repeaters, and bonding polyethylene to natural rubber in submarine cable. This last operation presently requires the use of four intermediate layers, and thus could be greatly simplified by the new process.

THE NEW 756A Crossbar Dial PBX is a small "packaged" design that matches the decor of modern offices. It is supplied with capacities of either forty or sixty lines and it can be equipped for six to ten central-office trunks. The dial equipment is housed in modular units that are similar to filing cabinets in size and appearance. No floor bolts are required, the power supply is completely self-contained, and an extra cabinet can be supplied when batteries are needed as a reserve power source. An attractive fea-

ture is a small, desk-top console for the PBX attendant. With push-button keys and simplified operation, this console permits the one attendant to perform PBX duties and also to act as secretary or receptionist. For small installations, a six-button telephone can be used, or a regular PBX switchboard can be installed if desired.

WESTERN ELECTRIC COMPANY combined engineering and manufacturing intervals for No. 4 type toll switching systems have been reduced four to 16 weeks for new jobs and three to eight weeks for additions, effective on new orders received at Kearny after January 1, 1958. The "task force" for shortening intervals is continuing its investigation into other items of toll equipment and expects that reduced intervals for these items will soon be announced.

IN ORDER to gain needed manufacturing experience, Western Electric has been producing exchange-type aluminum conductor cables at an annual rate of about five billion conductor feet. A recent review indicates that sufficient experience has now been obtained in manufacture and use of such cables to warrant a cut-back in production to a one BCF annual rate in 1958. This rate of production will permit continuation of necessary development in methods of applying pulp insulation to aluminum conductors. Further work remains to be done in perfecting this operation. It will also ensure retention of manufacturing know-how which would be essential in the event that the System were obligated to utilize large quantities of aluminum due to unavailability of copper.

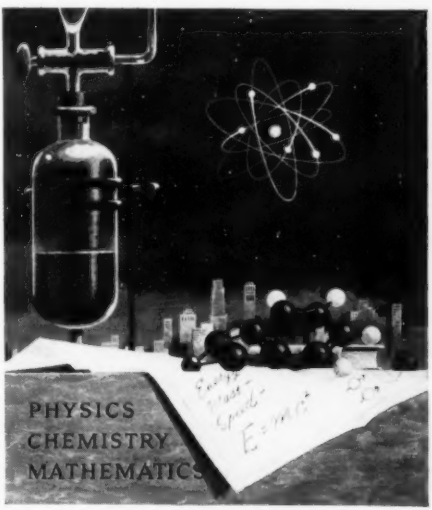
The Blue Pencil

SYMBOLISM is an interesting field of art, since it appeals to each viewer's own imagination, and tells him no story save that which he himself chooses to see in what the artist has placed before him. Robert Geissmann has done this well in his handling of our front cover, we feel, since his painting unmistakably suggests the elements of basic research—which is the topic of President Kappel's thought-provoking talk that occupies first position in this issue.

For such of our readers as may have some special interest in Mr. Geissmann's painting, we have a few extra copies of our cover picture. If you want one, just write to the editor.

MR. GEISSMANN'S gift of interpretive symbolism will be of particular interest to the philatelists among our readers (stamp collectors to you), because he is the designer of the three cent "Flushing Remonstrance" stamp issued by the Post Office Department last December 27. It is arranged vertically, printed in black in sheets of 50. An initial printing of 100,000,000 was authorized.

The stamp commemorates the tercentenary of a written protest by English settlers in



Geissmann design

XUM

Geissmann design

Flushing, N. Y., against religious persecution by Peter Stuyvesant, the peg-legged Dutch Colonial Governor of New Netherlands. Historians called this protest the Flushing Remonstrance, and Postmaster General Summerfield has stated that the stamp honors "religious freedom in America and the Flushing Remonstrance."

A philatelic publication says that the stamp "has for its central subject a Bible, which bespeaks the everlasting truth; a hat, symbolic of the people and the times; and a quill, which is the symbol of man's determination to speak the truth through the written word." An ornamental ribbon bears the message: *1657 The Flushing Remonstrance 1957*," and in the upper part of the stamp appear the words "Religious Freedom in America."

A plate block of these stamps, autographed by the designer, is reproduced in reduced size nearby.

EVERY EDITOR deals with words: they are his tools, his stock in trade, the things he lives by. They become fully operative—effective—only when printed, however; and whether there be an intermediary, of quill or yellow pencil or pounded typewriter, the editor is pretty generally sensitive to type faces and printing presses and printers. In a recent issue of *Editor & Publisher*—a trade journal whose field of service is implicit in its title—this editor came upon such a statement, which, with its attendant circumstances, interested him greatly – indeed, moved him. He hopes you will derive from it some comparable and enjoyable feeling.

From here on, *E&P.*:—

Robert St. John, famous newspaperman-author-traveler, whose latest book, "Foreign Correspondent" (Doubleday) was published this Fall, writes:

"In Kumasi, a city which is the capital of Ashanti, which in turn is one of the three provinces of Ghana, the newest country under the sun, I paid a call on the King of the Ashanti, and also a call on the editor and publisher of the Ashanti *Pioneer*, the only daily newspaper in the country, outside of one or two in Accra, the capital. On a large sign hanging over the door of his newspaper plant I found these words, which greatly appealed to me:

This is a Printing House.
  Cross roads of Civilization,
Refuge of all the arts
  Against the ravages of time,
Armory of fearless truth
  Against whispering rumors,
Incessant trumpet of trade.
From this house words may fly abroad,
  Not to perish as waves of sound,
But fixed in time;
  Not corrupted by the hurrying hand,
But verified in proof.
  Friend, on entering this house
You stand on sacred ground.
  This is a printing house.

"J. W. Tsiboe, editor and publisher of the paper, told me he made up the words himself, many, many years ago and had a local college art student paint them in large letters over his door on the bare white wall of the building. Mr. Tsiboe is an African, of course; what an unthinking person, not knowing how highly intelligent some of those people are, might carelessly call a 'barbarian' or a 'primitive' person! I defy many of 'our people' to put the case for the printed word any better!"

WE ARE STUMPED: pleasantly so, perhaps, but completely puzzled, nonetheless, about why so many people, so many *kinds* of people, from so many parts of this country and abroad, should want copies of the Cumulative Index of Vols. XXVI-XXXV of the BELL TELEPHONE MAGAZINE, which was offered in our last Autumn issue.

Such a volume, however useful, must be drier than a big-city telephone directory, and you think of it as having value chiefly in connection with bound volumes of those issues. But we have had requests for well over a hundred copies of the Index—and we don't believe there are so many sets of bound volumes extant. Telephone company libraries, public libraries, college and industrial libraries—yes, that you can understand. But why the telephone engineers obviously far from any headquarters point, and the unidentified people who, if they have any connection with this business, fail to say so?

This is just idle curiosity. The presumption might well be that if people want the Index, a need for it must exist. It was a do-it-yourself job of production, at minimum expense, and the supply is standing up to the demand so far.

Well . . . it does show that the MAGAZINE is read.

AND NOW, what about "instrumentalities"—as referred to, with a request for short synonyms and hypothetical reward of Oliver typewriter – in this place last Autumn? Responses not numerous, but of high quality and predominantly from feminine readers.

The first response was from a young lady right in our own department, who informed us with evident pride that she owns—present tense—an Oliver. No synonyms, though.

A teacher, feminine, says "ways and means" will do it. It sounds so simple and unpretentious that we have it in mind to substitute it – or them – for the ponderous monster, first chance we get.

A masculine contributor suggests that "instrument" is all it needs, but we don't entirely agree. Whether you like it or not, the extra three syllables confer a weight, a pseudo importance – which we suspect is why the longer word enjoys both use and acceptance —of specious significance.

Our most recent and most vocal contributor reports that our instrumentalities leered back at her in print—apparently, and understandably – because she has recently been teaching Better Business Writing, and has been afflicted with inarticulate engineers. Some very pertinent observations and discussions lead us to feel that she is, in general, on our side; but her final comment, that "Next year or the year after, it will probably become 'instrumentalizations' anyway," sounds as though she may not be altogether optimistic.

That's all for now from this lay writer.

JSB

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